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SOCIOMETRY

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Sociometry is concerned with the entire range of interests and problems represented by research in social psychology. It is the policy of the editors to seek those manuscripts for publication which represent the significant research interests of investigators who are concerned with giving the field of social psychology theoretical structure and reporting research which is clearly focused, well designed, and competently conducted.

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Differential Mediation of Social Perception as a Correlate of Social Adjustment[1]

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The experiment reported here was part of a broadly-framed research program aimed at isolating perceptual-cognitive variables underlying valid role-enactments. Our method was to predict from sociological classifications representing different end-products of socialization to performance on a series of experimental procedures. Because of the practical interest of such research, the groups we chose to contrast were psychopathic (as opposed to adventitious or neurotic) juvenile delinquents and non-delinquents.

The theoretical notions (16, 17) out of which we formulated our hypotheses assert that psychopathy is a result, in part, of fixation or overlearning during certain stages in the maturation-enculturation sequence. Such fixation or overlearning follows from prolonged trauma, neglect, and deprivation during infancy. Among its primary effects is a lack of differentiation of perceptual-cognitive functions. This failure to differentiate is reflected in various forms of conduct and is most readily conceptualized as social retardation. The form of social retardation which attracted our interest was inaccuracy of social perception.

Lacking systematic longitudinal data about our subjects, we would not venture to assert that each of our delinquents has undergone the sorts of experiences which presumably result in fixation at an early stage in the developmental sequence or that our non-delinquent subjects were uniformly free of such influences. However, case studies and analytic studies (11) in the past have demonstrated frequent socially-pathognomonic influences—privation, traumata, isolation, neglect, etc.—in the early lives of the class of delinquents we have tried to sample.

On the descriptive side, Gough (10) has surveyed the literature on psychopathy and has indicated that substantial agreement exists among writers of many diverse persuasions concerning the conduct specified by

[1] No. 9 in a series entitled *Contributions to Role-Taking Theory*. The study reported here is one of a series designed to identify the intrapersonal characteristics of psychopathic delinquents and is supported, in part, by Grant M-575 and M-575 (C) National Institute of Mental Health, Public Health Service, Theodore R. Sarbin, principal investigator. We acknowledge with gratitude the cooperation of Dr. Merle Elliott, Director of Research of the Oakland Public Schools, Dr. Burton E. Castner, California Youth Authority, and Dr. Winfield F. Wickham, Alameda County Probation Department.

that diagnosis. On the basis of this area of agreement, he suggests that the psychopath can best be described as an individual who is retarded or suffers a deficiency in the ability to perceive the role-of-the-other and is consequently unable adequately to predict the behavior of others. We feel some justification, therefore, in asserting that our delinquent sample was drawn from a class of persons who can be considered exemplars of social retardation.

The present study focused initially on the relative social-perceptual accuracy of our two groups of subjects. If we are correct in proposing that the psychopathic delinquent is socially retarded in the special sense of not being able adequately to differentiate self from others or to differentiate between different others, then, when faced with the task of predicting the tested preferences of standard social objects, the delinquent subject should achieve less accuracy than his non-delinquent peer. This was our first hypothesis: that the delinquent's failure to differentiate would result in lower accuracy.

Our experiment was also designed to investigate an hypothesis concerning the effect of increased knowledge on predictions of the conduct of others. We assume that the process of forming an impression of another person involves the progressive differentiation of unique individual characteristics out of an initially broad cognitive structure representing a general class of people. In our view, the social retardation of the delinquent is a consequence of his inability to make new differentiations—to learn from experience, as it were. On this reasoning, we anticipated that our delinquent subjects would show less improvement than our non-delinquent subjects when placed in a situation providing cues which would permit an increase in the validity of their conceptualizations of another's role.

A third hypothesis was developed when alternative scoring systems came under consideration after our data were collected. It has been commonly noted that some subjects in social prediction experiments tend to respond in a similar fashion whether they are describing themselves or predicting the responses of another person. This phenomenon has been variously conceptualized as "assumed similarity" (8), "projection" (12), and "perseverative conventionality" (9). The terms "assumed similarity" and "projection" possess surplus meanings to which we cannot subscribe: in addition to their other implications, both conceptualizations suggest a greater degree of complexity and organization in the cognitive processes of the subject than seems to us to fit the case. That is to say, such terms suggest without sufficient cause the presence of intentionally-directed inferential processes. Gage's almost purely descriptive use of the term "perseverative conventionality" seems more appropriate in that it emphasizes that the phenomenon is a characteristic of the response system of the subject and has little

reference to the interaction of the subject and a social object. To us, this perseverative phenomenon seems best conceptualized as *non-differentiation*. As we have used the term in this paper, non-differentiation refers to a response-characteristic—i.e., a failure to respond differentially when one is attempting to occupy various discriminable roles—which is assumed to reflect a characteristic of some underlying cognitive structure. While we had originally planned to correct the accuracy scores of our subjects for non-differentiation as Hastorf and Bender (12) recommend, the foregoing considerations directed us to treat the variable separately, particularly since the hypothesis that the responses of delinquents will show less differentiation than the responses of non-delinquents is more continuous with our theoretical orientation.

METHOD

Subjects

The subjects were forty-one delinquent and forty-eight non-delinquent adolescent boys. All subjects were white, between fourteen and eighteen years old, free from any major physical defect or record of chronic illness, from an urban area, and not markedly retarded in school placement. The delinquent group was composed of institutionalized boys who had records of three or more convictions for serious offenses (i.e., boys whose offenses consisted of relatively minor transgressions such as truancy or running away from home were excluded). An effort was made also to select boys whose records seemed to indicate that their transgressions arose from the impulsive gratification of immediate needs rather than from submission to peer group pressures or as the responses of a neurotic seeking punishment. The delinquent group was thus composed of boys whose socially unacceptable behavior appeared to reflect an inability to delay gratification and whose conduct had not been critically affected by repeated periods of incarceration. Such a group should contain a substantially greater proportion of psychopaths than the general population.

The non-delinquent group was composed of students at a technical high school who had no formal record of delinquency and who were not known by the administration or faculty of their school to have been in any serious but off-the-record trouble.

Materials

Each subject predicted the responses of two social objects to the nonverbal preference test described below. Standard samples of the social object's behavior were presented to the subjects by means of two four minute sound movies.[2] Prior to the interviews which comprised the main content

[2] Dr. Victor B. Cline served as cameraman and technical advisor in the production of these films.

of these movies, each social object was shown a film about flying.[3] He was then ushered into a small interview room where one of us (T. R. S.) asked him to tell about the movie he had just seen and encouraged him to keep talking by framing broad non-directive questions. These social objects were filmed (without their knowledge) through a one-way mirror located behind the interviewer. (After the films were developed, they were of course shown to the participants, both of whom readily granted permission for their use.) At the end of three minutes the interviews were terminated and the social objects were given instructions for the preference test. The films were terminated as they began the tests.

Since this study was performed as part of a larger project we were on a highly restricted time schedule, which accounts for the otherwise unjustifiable use of only two social objects. In an effort to compensate for the limitations introduced by using such a small sample on the object side, we selected as the objects of judgment two boys who were maximally different (among the six boys we initially considered) both in terms of their sociological classification and in terms of their responses to the preference test. In this way we hoped to minimize the influence of similarity between subjects and social objects by assuring that if a subject were similar to one object he would be dissimilar to the other.

Of the social objects used, one was a fifteen year old high school student who was an active participant in extra-curricular activities and who had no record of problem behavior. The other was a seventeen year old boy, at that time on probation from the juvenile authorities, who fit the criteria of our delinquent group. (For convenience of presentation, the social objects will hereinafter be referred to as O_n and O_d, non-delinquent and delinquent, respectively.)

Since we did not want possible differences in ability and motivation for dealing with verbal material to enter into our results, we used for prediction purposes a specially constructed non-verbal preference test. This test was composed of thirty magazine pictures of people engaged in a variety of occupational and recreational activities. The thirty pictures were divided into ten sets of three, which made up the ten "items" of the preference test. The three pictures in each item were selected to be roughly equivalent in the social status and income of the activities shown and to present a range along some dimension of social interaction. For example, one of the occupational items included pictures showing an engineer in a planning conference, a doctor examining a group of children, and a biologist determining the metabolism of a hummingbird. One of the recreational items included pictures of two boys playing chess, a boy and a girl dining in a restaurant, and a group of boys and girls at a beach party.

[3] *Problems of Flight.* Encyclopedia Britannica Films, 1950.

TABLE 1

Comparison of Obtained and Expected Frequencies for the Prediction of First Choices on the Non-Verbal Preference Test

Number of First Choices Correctly Predicted	Expected Frequency	Obtained Frequencies	
		O_a	O_d
5–10	7.46	23	15
3–4	17.07	10	15
0–2	10.47	2	5
N	35.00	35	35
χ^2		42.15	10.73
P		$<.01$	$<.01$

At the end of his interview, each social object was instructed as follows: "I have here a number of pictures of people doing different things. I'm going to show them to you three at a time. Each time I show you a set of three pictures, I want you to tell me which of the activities shown you would most enjoy doing yourself, and which you would least enjoy. All right, here's the first set. Which of these activities would you most enjoy? Which would you least enjoy?" The movie was stopped at this point. That the two social objects differed greatly in their response to the preference test is indicated by the fact that they chose the same alternative as most preferred for only two of the ten items.

That the choices of these two social objects could be predicted at least better than statistical chance is indicated by Table 1, in which the number of correct predictions of first choices by ten college students and twenty-five high school students is compared to the number expected on the basis of the binomial expansion. It will be noted that χ^2 satisfies a given level of significance for both objects. Since it is quite doubtful that the alternatives of these items are all equally likely to be chosen by adolescent boys, the binomial expansion does not provide an accurate estimate of chance frequencies. In the absence of an appropriate model of psychological chance, however, we offer the present comparison as an indication that the predictions of our subjects were at least non-random.

Procedure

During his first contact with the project, each subject was told a cover story. The project was represented as an attempt to study a variety of procedures as potential devices to select Air Force pilots. It was made clear that these were not actual selection tests, but simply tests that might be used later if they looked promising. It was hoped that this cover story would

remove the procedures somewhat from the realm of academic activity and increase the interest of both groups of subjects.

Each subject came to the procedure of this study individually. He was seated approximately ten feet from a small movie screen and the experimenter read the following instructions:

> A pilot often must assume a position of leadership in working with ground crews or with the members of a plane crew. He must be able to size up new men rapidly so that he will know what to expect from them, what they will like and dislike and so on.
>
> This is a test of how well you can guess what another person will do when you don't know him very well. You will be shown two short movies, each one showing an individual telling about a movie he has just seen. After each one, you will be asked to make some guesses about the sort of things that person would like to do.
>
> All right, here's the first one.

After the film had been shown, the experimenter read the following instructions:

> As you have seen, the boy in this movie was just starting to sort some pictures according to how much he thought he would enjoy the activities they showed. Here's the first set of pictures he sorted. Which one of these activities do you think *he* liked most?

The subject's response was recorded, and then the experimenter said either:

> Well, actually he chose this one first.

or:

> That's right, he chose this one first.

The rest of the pictures were shown, the experimenter repeating instructions as necessary and informing the subject of the correct response after each prediction. The second film was then run. After the second movie, the experimenter said:

> This boy sorted the same pictures as the other boy. Which of these did he say he would enjoy most?

The rest of the pictures were shown, the subject again being informed of the correct response immediately after he had made his choice, and the subject's responses were recorded. The experimenter then said:

> Now I'd like to know what your own preferences are. Which of these activities would you enjoy most *yourself?*

RESULTS

Each subject was assigned an accuracy score consisting simply of the number of correct predictions of first choices he made. This total accuracy score was broken down into four subscores: one for each half of the preference test for each social object. The means for these subscores for the two

TABLE 2

Mean Accuracy Scores of Delinquent Group and Non-Delinquent Group

Delinquent Group				Non-Delinquent Group			
Social Objects	Preference Test			Social Objects	Preference Test		
	First Half	Second Half	Total		First Half	Second Half	Total
O_1	2.1	2.3	4.4	O_n	2.4	2.7	5.1
O_2	2.1	2.2	4.3	O_d	1.8	2.2	4.0
Total.....	4.2	4.5	8.7	Total	4.2	4.9	9.1

groups and marginal combinations of them are shown in Table 2. Our first two hypotheses concerning accuracy of prediction were evaluated by means of these data. It will be noted in Table 2 that the differences between groups relevant to these two hypotheses are both in the expected direction. The mean total accuracy score is slightly higher for the non-delinquent group than for the delinquent group: 9.1 as compared to 8.7. The non-delinquent group showed a slightly greater improvement in going from the first half of the test to the second half than did the delinquent group: mean accuracy scores were 4.2 for both groups in the first half of the test, increasing to 4.9 for the non-delinquent and 4.5 for the delinquent group in the second half.

While these differences are in the predicted direction, they are small, and the analysis of variance reported in Table 3 indicates that the difference between groups and the interaction of groups and improvement are both clearly not significant. Both hypotheses about accuracy, then, are unconfirmed by our results.

It will be noted in Table 3 that there are three significant *F*s. The finding of a significant difference in the predictability of the two objects is not unusual and will not be discussed here. The finding of significant improvement in accuracy with knowledge of results, however, is of considerable interest since it indicates that we were successful in creating a situation in which roles could be learned. This result is of particular interest in connection with the significant interaction of groups and objects. Inspection of Table 2 reveals that this interaction reflects the fact that the non-delinquent subjects were more accurate than delinquent subjects in predicting the responses of the non-delinquent social object (O_n) but less accurate in predicting the responses of the delinquent social object (O_d). We propose a speculative interpretation of this finding as follows: The non-delinquent O_n was a more familiar type of individual to our non-delinquent subjects and consequently presented cues which could be readily assimilated to a pre-existing cognitive structure for this-type-of-boy, or this social role. The

TABLE 3

Analysis of Variance of Accuracy Scores

Source of Variation	d.f.	Mean Squares	F*
Groups: Delinquent v. Non-delinquent	1	.670	
Between Subjects in the Same Group	87	1.063	
Total Between Subjects	88		
Objects: O_n v. O_d	1	10.113	9.771‡
Improvement: First Half v. Second Half	1	5.438	5.254†
Interaction: Groups × Objects	1	6.863	6.641†
Interaction: Groups × Improvement	1	.313	
Interaction: Objects × Improvement	1	.044	
Interaction: Groups × Improvement × Objects	1	.012	
Pooled Subjects × Objects × Improvement	261	1.035	
Total Within Subjects	267		
Total	355		

* The mean square for groups was tested against the mean square between subjects in the same group. The mean square for pooled Subjects × Objects × Halves was used as the error term in all other tests.

† Significant at the .05 level.

‡ Significant at the .01 level.

delinquent O_d, on the other hand was probably a type of social object with whom our non-delinquent subjects had had much less commerce. The cues available were initially assimilated to an inappropriate role concept. It is noteworthy that the difference between groups in accuracy of predictions of O_d occurred entirely during the first half of the preference test. The achievement of the role-concept of the delinquent O_d by our non-delinquent subjects is supported by observations suggesting the occurrence of "insight". For example, one boy after making two correct predictions in the first five trials, said "Holy Cow! He didn't seem smart", and then made four hits in the next five trials. Another boy after making no hits in the first five trials, said "I've got him just backwards", and was right in three of the next five trials. Such verbal indications of re-orientation were not common, but it is suggestive that they did occur occasionally in the non-delinquent group but not at all among the delinquents. (It should be noted that these statements are not a function of "number of remarks" made by the non-delinquent boys. In fact, in another part of the experimental series, the delinquent boys made more spontaneous remarks than the non-delinquents.) In the light of the above observations, it seems likely that a longer

preference test would have permitted the non-delinquents further to consolidate their concepts and would have thus accentuated the group differences. We plan a further experiment in this series which will employ a considerably enlarged prediction instrument.

While our two achievement hypotheses cannot be considered either confirmed or infirmed by these data, our hypothesis that delinquents would make less differentiated responses than non-delinquents is supported by two lines of evidence. The first involves a direct measure of differentiation. The experimental procedure required our subject to adopt three different roles in responding to the same set of items. As far as test responses were concerned, at least two of these roles—those defined by the social objects—demanded quite different responses. The responses dictated by the subject's self-defined role might be similar to those required by either of the object-defined roles but could not be similar to both. If a subject in response to a particular item predicted the same alternative for both social objects that he chose for himself, then we considered that he had failed to differentiate among the three roles. Following this rationale, we assigned each subject a differentiation score consisting simply of the number of failures to differentiate—i.e., the number of items to which he gave the same response in all three roles—subtracted from ten. Figure 1 shows the distribution of these differentiation scores for the two groups. It should be noted that 17 percent of the delinquents, but none of the non-delinquents, received scores below 7, while, at the other end of the scale, 25 percent of the non-delinquents, but only 10 percent of the delinquents received scores of ten.

While the difference between the groups appears striking when graphically presented, the Mann-Whitney U-test indicates a probability of slightly more than .05 (one-tailed). There is no way to determine the exact probability for these data, but an approximation can be obtained by converting the rank totals used in the Mann-Whitney test to a normal deviate, as suggested by Mosteller and Bush (13, pp. 316–317). This procedure gives Z equal to 1.61, indicating a probability between .05 and .06. It should be noted that the Mann-Whitney test is non-specific, i.e., it is sensitive to all differences between distributions. However, it is obvious from Figure 1 that the difference in the means of the two groups contributes substantially to the overall difference between the distributions.

Further support for the differentiation hypothesis is found in the comparison of correlations between accuracy scores for O_n and O_d within the delinquent and non-delinquent groups which is presented in Table 4. Since the actual responses of O_n and O_d were highly dissimilar, a subject who failed to differentiate between the two Os in predicting their responses could score either low to moderate for both or high for one and low for the other. The subject could not achieve a high level of accuracy in predicting the

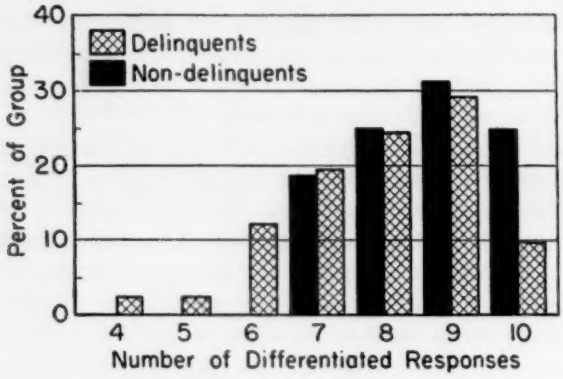

FIG. 1

TABLE 4

Correlation of Accuracy Scores (O_a v. O_d) within the Delinquent and Non-Delinquent Groups

Group	r	z
Delinquent (N = 41)	−.29	−.299
Non-delinquent (N = 48)	.13	.131
Difference		.430

$C.R. = 1.96$ $P < .05$

responses of both *O*s without making differential responses in the two roles. Any pronounced tendency within a group of subjects not to differentiate between the social objects would result in a negative correlation between accuracy scores. Within a group which tended to make differentiated responses, on the other hand, one should find a zero or positive correlation between accuracy scores. As is shown in Table 4, there was a correlation of −.29 between accuracy scores within the delinquent group, which is significant at the .07 level (.04 if one uses a one-tailed test). This correlation is, furthermore, significantly different at the .05 level from the correlation of .13 within the non-delinquent group. The correlation within the non-delinquent group is not statistically significant, but it is, however, within the range of correlations between social objects commonly reported in the literature: Stone and Leavitt (20), for instance, report correlations ranging from .11 to .30 among accuracy scores for four objects, and Gage (9) reports a median correlation of .20 among accuracy scores for six objects. These results, then, again indicate a tendency on the part of our delinquent subjects not to differentiate as well between different roles as did our non-delinquent subjects.

In summary, our results indicate that our delinquent and non-delinquent subjects did not differ significantly in the level of social-perceptual accuracy they achieved. They did differ, however, in the manner in which they achieved accuracy. The conclusion which seems indicated to us is that the social perceptions are differentially mediated, the delinquents tending to assimilate the roles of others into a single, undifferentiated cognitive structure and the non-delinquents tending to perceive others in terms of differentiated role concepts.

DISCUSSION: THEORETICAL

The polarity, differentiation-non-differentiation, has been fruitfully employed by investigators and theorists in many sciences. Whether used by embryologists (7), comparative psychologists (2), behavior pathologists (5), or social psychologists (14) the notion of differentiation (and its coordinate, hierarchization) has demonstrated a useful descriptive and analytic function. In essence, the concept implies an active process of detailing, partitioning, separating of figure from ground, separating of part from whole, isolating cue from surround, etc. Increasing differentiation normally develops concurrently with physiological growth and/or learning. The latter term, in this context, stands for traces or residuals within the organism which result from interaction with stimulus objects and events.[4] The failure to differentiate stimulus objects, particularly social stimulus objects, from the self has been listed as a characteristic of emotionally-disturbed (15), cognitively under-developed (21), socially-immature (6) and/or psychopathic (10) persons. Close scrutiny of the referents attached to these diagnostic terms allows the inference that all of them may be grouped under the generic term *socially-retarded*. The roots of social retardation or arrestment, we believe, lie in fixations occurring at certain phases in the maturation-enculturation sequence. If the organism fails to proceed through the differentiations normal for his species, class, group, or society, we apply the term retardation.

Psychologists are familiar with one specialized kind of retardation as expressed in intelligence test measures. The retardation we are discussing is broader in conception and, incidentally, has received scant attention from experimenters and theorists. Easily recognized as ineptness in social behavior, such retardation, we believe, is actually based on arrestment in perceptual-cognitive development. This arrestment is manifest, in part, as relative inability to form complex concepts, including such socially-derived

[4] Werner (21), for example, has demonstrated the organizing power of this concept in his comparative studies of child development in which he employs five pairs of sub-concepts in defining levels of psychological development: syncretic-discrete; diffuse-articulated; indefinite-definite; rigid-flexible; and labile-stable. These sub-concepts are used in specialized ways to analyze and describe psychological differentiation.

concepts as self and roles. The ability to differentiate self from others, as well as the ability to discriminate among various others, follows the developmental continuum. The observations of Bayley (1), Bühler (3), and Shirley (19), and others all point to gradual differentiation of self first as a physical object among other physical objects and later as a social object. This differentiation is best denoted as a low-order abstraction or cognition. It is the *Anlage* of the ability to use social abstractions, including such social concepts as roles.

That fixation or overlearning can occur before complete differentiation on the perceptual-cognitive dimension is a postulate of most, if not all, modern psychological theories. Experimental evidence is drawn mostly from animal studies (2), but the transition to human animals does not involve radical assumptions. In human children, fixation can occur during the plastic period when self-and-other differentiations are not well developed. Fixation, according to theory, prevents or slows up the development of new differentiations and, coordinately, hierarchizations. This maldevelopment will show up in various forms of social retardation—manifest as inept role-enactment.[5] Given the premises of our study, that our delinquents had childhood histories that would favor fixation early in the maturation-enculturation sequence, our data allow the inference that the non-differentiation associated with psychopathic delinquency is a developmental residue.

DISCUSSION: METHODOLOGICAL

Our experience in this study has led us into a critical appraisal of the methodology of social prediction experiments, with special reference to the handling of mediating variables which, to use Brunswik's figure, function as "links in the causal chain" (4, p. 4) connecting the responses of objects and the predictions of subjects. The point of view we have developed is that the process or act of knowing others, whether it be labeled diagnosis, clinical inference, or social sensitivity, is a complex perceptual-cognitive *achievement*. That is to say, accuracy of prediction of the behavior of others is, in Brunswik's (4) sense, an achievement variable. The main implication of this position is that, like any other complex behaviorial outcome, predictive accuracy is probabilistically multiple-determined and can be neither adequately accounted for by reference to any single intervening variable—e.g., empathy—nor adequately assessed by any single experimental task.

Arbitrarily to modify achievement scores by correcting for one selected mediating variable—as Hastorf and Bender (12), for instance, have advocated—seems to us unjustified. What is the rationale which justifies correcting for "projection" but not for conceptual rigidity, personal distance,

[5] For a more complete account of the theory guiding this study, the reader is referred to two papers (16, 17).

parataxic distortion, ethnocentrism, or any other variable that might possibly mediate achievement? It is true, of course, that many of the variables which can be identified as influencing accuracy scores in a specific experimental situation seem unrelated to the interaction of subject and object—e.g., response sets and response properties such as differentiation—and thus appear to exercise only a fortuitous influence on achievement. But, while such factors may be unduly exaggerated or suppressed by a particular procedure, it seems quite possible that some of them play a role of genuine importance in real-life social perception, which is, after all, what we are interested in assessing. To assert that a general tendency to attribute one's own attitudes to others, for instance, should not be allowed to affect accuracy scores because it does not reflect "real understanding" is to remove social perception from the realm of achievement and make of it something mysterious and detached from behavior.

We might note that during the pre-reflective period of this study we did analyze our data with a "correction for non-differentiation" and found that the delinquents were significantly less accurate than the non-delinquents. However, this process is artificial: The truth of the matter is that the two groups (in this specific task) were not different in terms of achievement although they were different in the manner in which they arrived at their similar achievements. We do not take this result to be typical: rather we view it as the product of specific properties of our procedure. Operating in his normal social habitat, an individual predicts the behavior of many different others. If he makes these predictions in a non-differentiated fashion, he will certainly be right some of the time, but he cannot achieve a high level of overall accuracy: e.g., on an *a priori* basis there appears to be a necessary causal relation between differentiation (in the sense of making discriminations among people) and accuracy, albeit the relation may be of a low order. In this experiment, however, we artificially untied differentiation and accuracy, and so the non-differentiating subject was not at a disadvantage. It is our belief that, if we had required our subjects to predict the responses of a large number of social objects to a larger number and broader range of test items, then non-differentiation would have had such a low level of validity as a mediator of accuracy that our delinquent group would have demonstrated a significantly lower level of achievement than our non-delinquent group.

We see two main directives for future research in this brief discussion. The first of these is for theoretically-oriented research directed at delineating the mediational processes entering into social perception and particularly aimed at establishing the relative effectiveness of the various forms of mediation. Such a program would require first of all the development of an adequate general measure of social-perceptual accuracy. Until this basic research has been carried out, the results of experiments relating accuracy

to other variables clearly cannot be generalized beyond the specific procedures used. The second directive is that psychologists should address themselves more frequently to the problem of differential mediation of social-perceptual achievement within defined groups. Knowledge of the preferred mediational processes of such specific groups as delinquents, clinical psychologists, psychiatric cases, or congressmen, would not only be of considerable interest in its own right, but would also provide a basis for a more adequate conceptualization of social behavior.

SUMMARY AND CONCLUSIONS

A group of psychopathic delinquents ($N = 41$) and a roughly-matched group of non-delinquents ($N = 48$) were presented with a social perception task. On the basis of limited cinematographic cues, subjects predicted the behavior of two dissimilar social objects to a 10 item non-verbal preference test. Knowledge of results of success or failure of the prediction for each item was given the subject seriatim. Achievement, as measured by raw accuracy scores, failed to differentiate the two groups. The data suggest that the failure of confirmation of the initial hypothesis (that non-delinquents would have higher achievement scores than delinquents) was due to an insufficient number of social objects. Differential mediation of similar achievement scores, however, is demonstrated, thus confirming an hypothesis developed after the data had been collected.

From the first half of the prediction task to the second half, achievement scores increase for both groups. Analysis of the protocols suggests that the non-delinquents were artificially restricted in opportunities to "profit from experience" because of the small number of test items.

Delinquents tend to use more non-differentiating responses. That is, they tend to predict the same preference for each of the dissimilar social objects *and* for the self. Since lack of perceptual-cognitive differentiation is presumed to be one of the determinants of the social retardation reflected in chronic delinquency, this finding is taken as lending support to the theory which guided this study.

These results suggest that the attention of researchers in the area of social perception might profitably be directed toward delineating the mediational processes entering into social-perceptual achievement and examining the preferential use of specific mediational processes by different criterion groups.

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An Exponential Model for Assessing Fourfold Tables[1]

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Among the applications of latent structure analysis has been the assessment of the adequacy of cumulative or Guttman scales.[2] In most of the instances where this application has been made, the procedure has been to calculate the latent parameters corresponding to a small number of items and to use these parameters as measures of the adequacy of the scale. Hays and Borgatta (3) have compared two types of latent distance models for this purpose, and concluded that the more general of the two gives a better account of the data, though requiring more work in computation. Latent structure analysis has also been applied to cumulative scales by Henry (4) and Borgatta and Hays (1).

It is possible also to apply this general type of analysis to the initial process of selecting items to form a scalable universe. The selection of items is conventionally done, in the "Cornell" method as described by Guttman (2), by cross-tabulating each item against a provisional total score or sum of response scores for each respondent. An alternative procedure for selecting items, however, is the pairwise comparison of prospective scale items, described by Toby and Toby (7). The purpose of this paper is to apply the general reasoning of latent structure analysis to this problem of pairwise comparison of items.

The problem that led to the development of this model arose in the course of construction of cumulative scales from Congressional roll-call votes. In this work it was decided to test the adequacy of items by pairwise comparison of items near one another in the scale, rather then by the "Cornell" method. This decision rested chiefly on the research aim of distinguishing, within a given gross content area, two or more scales that might be highly associated with one another yet have different legislative significance. It was felt for this reason that the provisional total score would not furnish as precise a criterion of adequacy as would part of a scale itself, built by starting at one point and successively adding adjacent items if they met the proper criteria for membership in the scale. It was desired to place in one "scalable universe" not only items whose cutting points differed considerably from one another, but also items with nearly identical

[1] The research on which this paper is based was aided by the Institute of Social Sciences at the University of California, Berkeley. The writer is indebted to Dr. David G. Hays and Dr. Edgar F. Borgatta for helpful suggestions.

[2] An introduction to latent structure analysis has been given by Lazarsfeld (5). Cumulative scales are discussed at length in the same volume in which this treatment appears.

cutting points. This necessity resulted from the use of composite items, as proposed by Stouffer et al. (6), which in addition to their other advantages made it possible to place Congressmen who might have been absent on individual roll calls. The result of this procedure may be a set of scales, all highly associated with one another and with high reproducibility, yet distinct from one another.

The problem of pairwise comparison of dichotomies is thus posed in a general manner. What is needed is an objective test whether two dichotomous items might be said to belong to a common universe, within a specified degree of error. The data on which this test is to be based are those furnished by the fourfold table classifying all joint responses to both items in a pair (non-responding individuals being omitted). A typical fourfold table is shown in Table 1. In this table it is assumed that item 1 has the higher proportion of positive responses; therefore the cell proportions p_{++}, p_{+-}, p_{--} correspond to scale types and p_{-+} to a nonscale type as far as these two items are concerned. These four p's are the proportions of cases in the four cells, expressed as fractions of the total of all four cells. Marginal proportions are designated by replacing the subscript of the "absent" item by a dot.

The judgment whether two dichotomous items may be said to belong to a common universe, within a specified degree of error, depends on the model within which "error" is a parameter. The restricted latent distance model that has been used in the past assumes rectangular or "step-function" trace lines, as shown in Figure 1. The horizontal dimension represents the position of individuals on a latent continuum, x. The x-value for a given individual measures the proportion of all respondents having values of x equal to, or less than, that of the given individual. This means that the individuals are uniformly distributed over the interval from 0 to 1. The

TABLE 1

The Fourfold Table

		Item 2		
		+	−	
Item 1	+	p_{++}	p_{+-}	$p_{+\cdot}$
	−	p_{-+}	p_{--}	$p_{-\cdot}$
		$p_{\cdot+}$	$p_{\cdot-}$	1

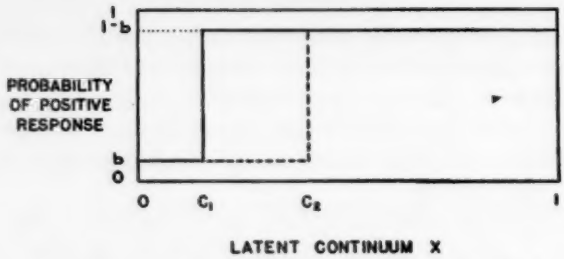

FIGURE 1. The restricted latent distance model

trace line of an item is a function of x indicating the probability that an individual at x will respond positively to the item. In this model, each item has a parameter c at which there is a sharp transition from low probability to high probability of positive response. For a perfect item these probabilities would be 0 and 1; for an actual item, according to this model, there is a uniform probability b of "error" or deviation from this sort of perfection. In the "restricted" latent distance model, the b-values at the top and bottom of the diagram are assumed to be the same. An item with a high probability of positive response will have a low value of c, and vice versa.

This model generates four equations for p_{++}, p_{+-}, p_{-+}, and p_{--}. The second and third of these can be combined to eliminate the variables c_1 and c_2, yielding an equation involving only the parameter b (the error measure) and the cell proportions p_{+-} and p_{-+}:

[1] $$\frac{p_{+-}}{1-b} + \frac{p_{-+}}{b} = 1$$

This can be expressed graphically in terms of lines of constant b, within the limits of the model (c must remain between 0 and 1), as shown in Figure 2. Any given fourfold table can then be classified within a b-interval by the use of such a graph. In this way a fairly rapid judgment may be made as to whether two dichotomies represent a single latent continuum, in terms of a model with rectangular trace lines.

It should be noted that the procedure used here, and in the treatment that follows, is not to solve for the error parameter, but to assume a "tolerance limit" for this parameter. We then find the relations between the p's that would hold if the error parameter had this value, and examine the nonscale proportion p_{-+} to see whether it is small enough, in view of these relations, to permit the assumption of an error parameter within the "tolerance limit."

In application to Congressional roll-call data, this model appeared to have some disadvantages:

a. It seemed to impose standards that were too rigorous, relatively speaking, on items whose cutting points were too far apart.

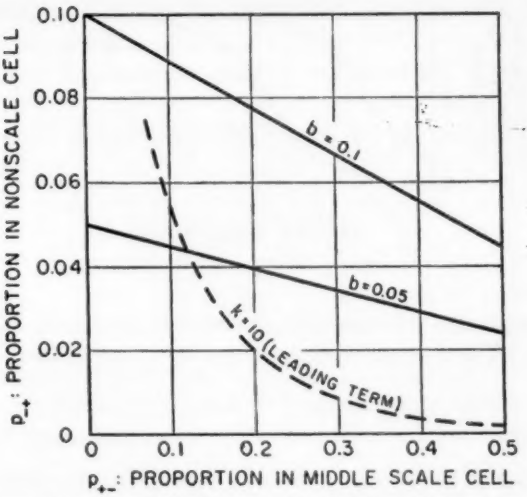

FIGURE 2. Lines of constant b in the restricted latent distance model. The dotted line is a line of constant error for a special case of the exponential model treated below.

b. It seemed to permit too much error at the ends of the scale, for a given amount of error in the middle.

Another way of expressing these points is to say that estimates of b appear to be higher when the cutting points of items are close together, and when the items are located near the center of the interval. These disadvantages are intuitive inferences from the ease or difficulty of finding pairs of items that satisfied the criterion for a given value of the error parameter ($b = .05$, for example), among those available in the vicinity of a given cutting point.

Because of these disadvantages, it appeared that the basic difficulty was with the rectangular form of the trace lines assumed in the model. In this application and others, it may be unreasonable to assume that "errors" are equally probable regardless of the respondent's position relative to the item. An alternative assumption is that the greatest chance of "error" exists when the cutting point of a measure is very near to the respondent's position, with less and less chance of "error" as the cutting point moves farther away.

One way of expressing this alternative assumption is in another model similar to the restricted latent distance model with the substitution of an exponential function for the step function. The model will again have one "error" parameter, the decay constant of the exponential; this is assumed to be the same for the two items under comparison. It will have the same properties of symmetry as the step-function model: the trace line on the left of the cutting point will be radially symmetrical to the trace line on the right, with respect to a central point. The location of this central point on

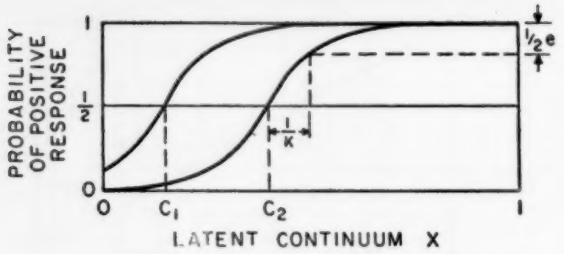

FIGURE 3. Exponential trace lines

the latent continuum will again be the second parameter of the trace line. (See Figure 3.) The general equation for a trace line in this model is:

$$[2] \qquad f(x, c) = \begin{cases} \frac{1}{2}\, e^{-k(c-x)} & \text{for } x \leqslant c; \\ 1 - \frac{1}{2}\, e^{-k(x-c)} & \text{for } x \geqslant c. \end{cases}$$

In general terms the expected values of the proportions in the cells of the fourfold table may be expressed as

$$[3a] \qquad p_{++} = \int_0^1 f(x, c_1) f(x, c_2)\, dx,$$

$$[3b] \qquad p_{+-} = \int_0^1 f(x, c_1)[1 - f(x, c_2)]\, dx,$$

$$[3c] \qquad p_{-+} = \int_0^1 [1 - f(x, c_1)] f(x, c_2)\, dx,$$

$$[3d] \qquad p_{--} = \int_0^1 [1 - f(x, c_1)][1 - f(x, c_2)]\, dx.$$

Each of these integrals must be evaluated over three segments of the variable x: from 0 to c_1, from c_1 to c_2, and from c_2 to 1. (We assume $c_1 \leqslant c_2$.) In the case where one or both c's lie outside the interval from 0 to 1 (to be discussed below), fewer segments need be considered.

The Case $0 \leqslant c \leqslant 1$

In the usual case, both c's may be assumed to lie in the interval from 0 to 1. The "nonscale" term, on which we wish to set limits in terms of the error parameter k, then turns out to be

$$[4] \qquad p_{-+} = e^{-k(c_2 - c_1)} \left[\frac{3}{4k} + \frac{c_2 - c_1}{4} \right] - \frac{1}{2k} \left[e^{-kc_2} + e^{-k(1-c_1)} \right] + \frac{1}{8k} \left[e^{-k(c_1+c_2)} + e^{-k(2-c_1-c_2)} \right].$$

A more convenient form of this expression may be obtained by introducing two new variables:

$\bar{c} = (c_1 + c_2)/2$, the average location of the central points of the two trace lines; and

$d = c_2 - c_1$, the distance between these two central points. Equation [4] then becomes

$$p_{-+} = e^{-kd}\left[\frac{3}{4k} + \frac{d}{4}\right] - \frac{1}{2k}e^{-\frac{1}{2}kd}[e^{-k\bar{c}} + e^{-k\bar{c}(1-)}] \tag{5}$$

$$+ \frac{1}{8k}[e^{-2k\bar{c}} + e^{-2k(1-\bar{c})}].$$

This expression may be interpreted by the consideration of some limiting cases. In the first place, k may usually be taken to be considerably greater than unity; in Figure 3, k has the value 10, which has seemed reasonable as a "tolerance limit" in application so far. If d is not much greater than $1/k$, and if $\bar{c}$ is far from the limits 0 and 1 relative to $1/k$, the nonscale proportion p_{-+} will be dominated by the leading term in [5],

$$e^{-kd}\left[\frac{3}{4k} + \frac{d}{4}\right].$$

This term does not involve the c's; with the "tolerance limit" for k considered as a constant, it is a function of d alone. It attains a maximum value of $3/4k$ when $d = 0$, i.e., when $p_{-+} = p_{+-}$. For $k = 10$, this maximum value would be .075; for $k = 10$ and $d = 0.1$, the leading term would drop to .037, and for $d = 0.2$, it would be .017. Thus the expected value of p_{-+}, when dominated by this term, falls off very rapidly as the central points of the trace lines are separated. For trace lines whose central points differ by as much as $5/k$, the leading term in p_{-+} will then be extremely small. Fourfold tables based on an *a priori* universe of content composed of roll call votes often have very small "nonscale" cells, and for this reason not much time needs to be spent in comparing items that are far apart.

This leading term would actually give the expected value of p_{-+} if the integral [3c] had an infinite range of integration in both directions. The remaining terms may be considered "end-effect" terms, taking into account the fact that the integral is evaluated only to finite rather than infinite limits. In these remaining terms in [5], each term has an exponent which involves the distance of $\bar{c}$ from one of the limits 0 or 1. Therefore if $\bar{c}$ is far from the ends of the interval, relative to $1/k$, these remaining terms will be negligible.

As $\bar{c}$ approaches the ends of the interval, the "end-effect" terms come into

account. To see how great this effect is, we may consider the form assumed by [5] when $d = 0$; in this case $c_1 = c_2 = c$ and we may therefore write

$$[6] \quad p_{-+(\text{maximum})} = \frac{3}{4k} - \frac{1}{2k}\left[e^{-kc} + e^{-k(1-c)}\right] + \frac{1}{8k}\left[e^{-2kc} + e^{-2k(1-c)}\right].$$

At $c = 0$ or 1 (still assuming large k) this is approximately $3/8k$; the end effects reduce the expected value by half, because practically half of the significant range of integration for the two functions in the integral [3c] is beyond $x = 0$ (or $x = 1$).

For practical calculation of p_{-+}, equation [5] can be used, provided that a value of d is available. The value of k which is being used as a criterion may be supplied; the value of $\bar{c}$ is relatively immaterial except near the ends of the interval; but d remains to be determined. Whereas in the case of the rectangular trace lines we were able to eliminate c_1 and c_2 from a set of simultaneous equations, thus obtaining equation [1], this does not appear possible with the exponential model.

We therefore use manifest values as an approximation to the latent parameter d. The expected value of p_{-+} may be evaluated on the basis of integral [3b] and expressed in terms of the known p_{-+}:

$$[7] \quad p_{+-} = c_2 - c_1 + p_{-+} - \frac{1}{2k}\left[e^{-kc_1} - e^{-kc_2} + e^{-k(1-c_2)} - e^{-k(1-c_1)}\right].$$

Thus when c_1 and c_2 are far from the ends of the interval relative to $1/k$, we may make an excellent approximation to d (i.e., to $c_2 - c_1$) by setting it equal to the difference between the two diagonal terms in the fourfold table, $p_{+-} - p_{-+}$. This is the same as the difference between the positive marginals of the two items. Moreover, whenever $c_1 = c_2$, even at the ends of the interval, our estimate of d will also always be zero. Otherwise, our estimate of d will be slightly too low for $\bar{c}$ near 0 or 1. The proportional error will depend on the distance from the end of the interval. For small values of d, if $k = 10$ and $\bar{c} = .10$ (or .90), the estimate of d will be low by a fraction of itself equal to $1/2e$, or 18%; if $k = 10$ and $\bar{c} = .05$ (or .95), the fractional error in our estimate of d will be $\frac{1}{2\sqrt{\bar{c}}}$ or 30%. The approximation therefore seems adequate as long as we do not look for cutting points much closer to the ends of the interval than $1/k$.

Near the ends of the interval, the c's become relevant and must also be estimated. The general expression relating c (c_1 or c_2) to the positive marginal p_+ ($p_{+\cdot}$ or $p_{\cdot+}$ in Table 1) is

$$[8] \quad p_+ = \int_0^1 f(x, c)\, dx = 1 - c + \frac{1}{2k}\left[e^{-k(1-c)} - e^{-kc}\right]$$

If c is between 0 and 1 but far from both relative to $1/k$, then the positive marginal proportion p_+ is a good approximation to $(1 - c)$; that is, c is approximately equal to p_-, the negative marginal proportion. For c near zero, p_- is an overestimate of c, and for c near 1, it is an underestimate. A graph of [8] can be used to estimate values of c, for a given value of k. In this procedure we assume that the error proportion p_{-+} is a monotonic decreasing function of k, for given marginals, in the range of k considered. Subject to this assumption we use the "tolerance limit" value of k to find c_1 and c_2, and from these find the tolerance limit for p_{-+}, using either [4] or [5]. If p_{-+} does not exceed this limit, then we accept the fourfold table as being within the required margin of error.

In one important case a simple graphical test is possible, to tell whether a fourfold table is within a given tolerance value of k. If c_1 and c_2 are far from the ends of the interval relative to $1/k$, and d is not much greater than $1/k$, then the leading term in [5] is a good approximation to the tolerance limit of p_{-+}, and d is well approximated by $(p_{+-} - p_{-+})$. We may then plot the leading term in [5] as a function of d, and either use this plot or convert it graphically to a function of p_{+-}. This latter function, for $k = 10$, is shown as a dotted line in Figure 2, and may be compared with the corresponding functions for the rectangular-trace-line model. The portion of this curve corresponding to low values of p_{+-} can be used only together with "end-effect" terms calculated from [4] or [5]. For calculations in cases where these corrections are necessary, graphs of the separate exponential terms in [4] are useful.

The Case $c < 0$ or $c > 1$

The exponential model as developed so far makes no provision for marginal proportions nearer to 0 or 1 than $1/2k$, since this is the smallest value that p_+ or p_- (from [8]) can assume with c between 0 and 1. Marginal proportions more extreme than this can arise only if c is allowed to assume negative values or values greater than 1. Extreme items of this sort have not been used widely in cumulative scales; at least for $k = 10$, the marginal proportions would not enter this range unless either less than .05 or greater than .95. Nevertheless, a brief discussion of this case is desirable for completeness.

The cases in which *both* c's are outside the interval from 0 to 1 do not present serious practical problems. If the c's are beyond opposite ends of the interval, we are dealing with a comparison of extremely distant items. The tolerable value of p_{-+} will then be extremely low; for with $c_1 = 0$ and $c_2 = 1$ the tolerable value of p_{-+} is $\frac{1}{4}e^{-k}$, which will very often correspond to an expected value of less than one case. If the c's are more extreme than this, the model will still tolerate practically no cases in this cell of the fourfold

table. This is a stringent requirement, but it does not create computational problems.

The case when both c's are beyond the same end of the interval is not of practical significance because it corresponds to the placement of an extremely small proportion of cases in the end scale type p_{++} or p_{--}. The smallest "end scale type" contains a proportion equal to $1/8k$ when $c_1 = c_2 = 0$ or 1, and contains a still smaller proportion when c_1 and c_2 are beyond the end of the interval. For $k = 10$, this would correspond to an end scale type including at most 1.25 per cent of the sample.

There remains the case when one of the c's is within the interval from 0 to 1 and the other is not. This case can most readily be treated by estimating from the marginals the values that the c's would have for the "tolerance limit" k by means of [8]. We may indicate how this would be done for $c_1 < 0$, bearing in mind that the analogous case $c_2 > 1$ is equivalent if we interchange c_1 and c_2 and use the transformed variable $x' = 1 - x$.

If $p_{+\cdot}$ is too large to fit on the graphical plot of [8], we may fit a negative value of c_1 to the data. In this case

$$[9] \qquad p_{+} = 1 + \frac{1}{2k}\left[e^{-k(1-c)} - e^{kc}\right],$$

or if $k \gg 1$, $p_{-} \doteq (1/2k)\, e^{kc}$, and $c \doteq (1/k)\log_e(2kp_{-})$. A value of c_1 obtained in this way, together with a value of c_2 obtained graphically from [8], can be used to calculate the "tolerance" value of p_{-+}, which in this case is given by

$$[10] \qquad p_{-+} = e^{-k(c_2-c_1)}\left[\frac{3}{8k} + \frac{c_2}{4}\right] - \frac{1}{2k}\, e^{-k(1-c_1)} + \frac{1}{8k}\, e^{-k(2-c_1-c_2)}.$$

If $k \gg 1$, the leading term in [10] is dominant and can be used to calculate the tolerance limits of p_{-+}. Since c_1 and c_2 appear separately, however, a two-dimensional graph cannot be used to simplify the computation.

DISCUSSION

The model proposed has proven useful in the identification of sets of items from which cumulative scales can be constructed. Some limitations of the model should nevertheless be made clear:

1. An exponential model may prove unduly stringent in its tolerance for only a small number of cases in the "nonscale" cell when the two items in question have cutting points very distant from one another. Values of p_{-+} that are not tolerated by the model may still not interfere greatly with the ultimate aim of constructing a cumulative scale. In this respect the use of an exponential function may overcompensate slightly for the deficiencies of a step function.

2. The exponential model has been applied only to a very limited task: the assessment of individual fourfold tables with respect to a "tolerance limit" defined in terms of an error parameter. The problem of estimating the error parameter for more than two items at a time has not been considered. The accompanying problem of goodness of fit also remains to be treated in detail. A rough notion of the goodness of fit of a model of this sort to a given set of items may be obtained by examining the proportion of fourfold tables that are acceptable in terms of a given tolerance limit as defined by the error parameter. If this "acceptance rate" is relatively independent of the separation d of the items, and if "acceptability" serves to define subsets of items within which all pair-relations are acceptable, then we have some reason to believe that the model fits the data.

SUMMARY

A latent-structure model using exponential functions in the trace lines has been proposed and some of its properties examined. It has been applied to one particular problem: the comparison of a pair of items with similar positive marginal proportions, to see whether they might have come from a common scalable universe. This operation is useful if one wishes to construct cumulative (Guttman) scales by pairwise comparison of items, rather than by using a provisional total score as an initial criterion of scalability. For pairwise comparison, this model is believed to be a more realistic one than the restricted latent-distance model using rectangular trace lines.

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APPENDIX

For a given fourfold table, the value of k can be found by numerical solution of the "marginal" equations [8] or [9] together with one of the equations [3]. The actual determination of k for a fourfold table, as opposed to its use as a tolerance limit, would have great advantages in assessing the actual degree of structuring of a given content area.

The process of solving for k appears also to be facilitated by use of a slightly different form of exponential trace line:

$$f(x, c) = \frac{e^{k(x-c)}}{1 + e^{k(x-c)}}$$

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Group Performance as a Function of Work-Distribution Patterns and Task Load[1]

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In attempting to accomplish some assigned change in their external environment, task-oriented groups typically assume some formal or informal structure: individuals are assigned to positions of leadership, communication channels specified, power relationships made explicit. As Christie *et al.* have indicated, "Such specifications or limitations are usually imposed to organize the group's behavior so that it attacks its task effectively, and although these imposed restrictions may sometimes achieve this aim, often they do not" (3, p. 7).

Research on communication structure by Bavelas (1), Christie *et al.* (3), and Leavitt (5), as well as studies of "power" and leadership structure by Hurwitz *et al.* (4), Lippitt *et al.* (6), and Carter *et al.* (2) have supported this general observation by indicating the wide variation in group performance which results from manipulation of structure variables. One aspect of structure, however, has been studied relatively little, experimentally. The problem involves the nature of the distribution of task responsibilities which will insure effective performance, a problem which presumably precedes considerations of leadership and communication structure. The paucity of research on this problem may reflect primarily the nature of the tasks typically used in small group research. Generally, the tasks have been such that the contribution of any single group member contains all the elements of a complete group solution. Any one person can produce a solution to the problem; distribution of task functions among group members is not "demanded" by the task. The research which does bear on the problem has dealt with a phenomenon of peripheral concern: the relative advantage of division of labor versus no division, in tasks where division of labor was not essential (e.g., 7).

Problems of work distribution are of special concern in military programs where the activities required for operation of many complex "systems" are impossible for a single individual to accomplish, necessitating the distribution of task activities among several operators or crew members. Present

[1] This study was performed in support of Project 7713 under the Air Force Personnel and Training Research Center, Lackland Air Force Base, San Antonio, Texas. Permission is granted for reproduction, translation, publication, use and disposal in whole and in part by or for the United States Government.

organization practices heavily stress as a basis for work-distribution decisions certain general principles such as unity of command, span of control, and homogeneous assignment. Although presumably based on wide experience, such principles have had little experimental validation. In addition, they are of such broad scope as to be inapplicable to many work distribution problems. Their breadth arises from the necessity of providing a framework for work-distribution decisions for a wide variety of tasks, differing along many dimensions, and for a variety of groups whose task environment is not invariant. If, as is usually assumed, the relative effectiveness of particular methods of work distribution is dependent on task parameters (e.g., work load, predictability of work demands, etc.), then, without explicit information of the nature of these interactions, only broad principles can be stated. The formulation of principles for effective group structure is considerably complicated by the probable importance of such interactions.

The present experiment is an exploratory study in this area. It investigates the relationship between two methods of work distribution and group performance, under two task load conditions. Two commonly employed structures were used: (a) a distribution in which the task activities are grouped in homogeneous "functional categories" and different homogeneous categories assigned to each individual, e.g., information processing or decision making; and (b) a distribution in which the total task is divided into sub-tasks and a sub-task assigned to each individual. In the second type of structure each sub-task may include all the functions required in the overall task, as might be the case if a group had to sort, tabulate, and file a large amount of data, and the data were equally divided among the group members.

METHOD

Task

The experiment employed a task modeled after that of an Air Defense Command Aircraft Control and Warning Center. A somewhat similar problem was used by Schutz (9). The basic component of the task was a metal-covered board 6′ x 5′ with a 50 by 40 grid identified by coordinates. Three discrete target areas were located roughly near the center of the board. Model planes with small attached magnets were utilized to provide an "enemy" and "friendly" air force. These marker planes were of three different colors: one color for definite enemy planes, one color for unidentified planes (which could be friendly aircraft in the area), and the third for friendly interceptors. All planes were numbered, in addition to having separate colors.

Three types of information were supplied to the group:

1. A continuous tape-recorded message reported the coordinates of all planes (other than friendly interceptors) at all times. Positions were reported for all planes on the board with no other identifying data or indication of whether this constituted a change in position for an aircraft. In other words, an attempt was made to make input correspond to the sweep on a radar scope.

2. A second input consisted of "flight plans" for friendly planes. These flight plans were reported at the beginning of the task and were in the form: "Friendly plane going from coordinate G-1 to coordinate H-50."

3. The third input was a time signal indicating intervals during which interceptor planes could be moved. Intervals were approximately four minutes long. During this interval aircraft positions were reported and had to be translated into moves on the interceptor board, and decisions had to be made concerning deployment of interceptors.

The interceptor plane pool consisted of nine planes, with three planes located at each "airfield" close to the three target areas. Each interceptor could make a two-space movement during the designated intervals but could remain away from a base for only seven consecutive time intervals. An interceptor plane "downed" an enemy plane or a misidentified friendly plane by landing on the square which that plane occupied. The interceptor was itself downed if an enemy plane landed on its square.

The general requirement of the task was to defend the three target areas against an attack by enemy bombers. This necessitated correct identification of friendly and enemy planes, and strategic deployment of the available interceptor force for "counter-attack." Scoring was in terms of the number of times the target areas were bombed, the number of enemy bombers downed, the number of interceptors lost, and the number of friendly planes accidentally downed.

EXPERIMENTAL CONDITIONS

Structure

Two types of structure were used; one based on a functional classification of activities (vertical structure) and the second involving a sub-task discrimination (horizontal structure).

Vertical structure. Three essential activities were distinguished: observation, calculation, and decision-making. One group member was assigned the task of monitoring the "position report" input and making the necessary plane moves on the intercept board (observer). The second group member was given responsibility for identification of aircraft to determine if they were friendly or enemy. He also was required to keep track of the fuel status of interceptor aircraft (calculator). The third group member

was responsible for all decisions concerning deployment of the friendly interceptor force (decision maker). The functional discriminations utilized were based on an analysis of the stages in the problem-solving processes of groups suggested by Roby and Forgays (8).

Horizontal structure. As previously mentioned, there were three target areas to be defended and three associated interceptor bases. For the horizontal-structure condition each group member was assigned the responsibility of defending one of the targets with the three available interceptor planes. Thus, each member had to move all planes in his area in response to position reports; each had to identify, as enemy or friendly, planes in his area; and each had to make decisions about the moves of his interceptor defensive force. In essence, the problem was broken down into three subtasks requiring all the activity demanded by the over-all task.

Task Load

Two task-load conditions were used. Under high-load conditions 15 planes were employed; nine were enemy bombers, six were friendly planes for which flight plans were submitted. Under low-load conditions 10 planes were employed; six were enemy bombers, four were friendly planes with flight plans. Two attack patterns for each task load were constructed.

Design

The basic design was a 2^2 factorial with four groups per cell. To reduce within-condition variance it was desirable to use a group for all four conditions. The limited number of subjects available and their limited available time (subjects could be obtained for only one day) necessitated a compromise design. Each group was run under both structure conditions, under one level of task load. The order of presentation of structure conditions was systematically varied, as was the order of the two attack patterns for a load condition, as shown in Figure 1 where the numbers in the cells designate a group.

Thus, Group 1 was run only under the high-load condition. For its first session it received attack pattern *a* using a horizontal structure; for its

FIG. 1. Experimental design

Load Condition	High				Low			
Session	1		2		1		2	
Attack pattern	a	b	a	b	c	d	c	d
Horizontal structure	G1	G2	G4	G3	G5	G6	G8	G7
Vertical structure	G3	G4	G2	G1	G7	G8	G6	G5

Note: G stands for group.

FIG. 2. Load and structure conditions in order of presentation

Load Condition					
High			Low		
Group	Session		Group	Session	
	1	2		1	2
1	H	V	3	H	V
2	V	H	4	V	H

second session it received attack pattern *b* under vertical structure. Similarly, Group 3 was run only under high-load conditions. The first session was under vertical structure with attack pattern *a*; the second used a horizontal structure with attack pattern *b*. The attack patterns were equated in terms of the total number of attacking enemy planes, the number of enemy bombers attacking a particular target, and the general complexity of the attack pattern (origin of bomber and number of moves to reach a target).

Ignoring attack patterns (which were equated), the resulting design is a modified latin square. This is shown in Figure 2 where horizontal and vertical structure conditions are designated by H and V, respectively.

The design was replicated four times resulting in four groups for each order of presentation of the structure conditions.

PROCEDURE

Experimental Procedure

The following steps summarize the experimental procedure for each group:

1. The three men were briefed on the general nature of the task; its analogy with an Air Defense Center was stressed.
2. The procedures to be followed in tracking and identifying aircraft were explained and illustrated. Questions were invited and answered by the experimenter (E).
3. A brief practice session was conducted with the group performing all the necessary procedures. This was followed by a critique by E.
4. Another brief practice session was conducted to assure adequate understanding of the procedures. This general orientation took between 20 and 30 minutes.
5. If the orientation was successful, the experiment proper was begun; if not, additional instruction was given by E. The experiment proper (Session 1) was approximately one hour long.
6. After completion of Session 1 the group members went to lunch.

7. Session 2 was started approximately two hours after Session 1. Only the new procedures necessitated by a change in structure conditions were explained at this second session.
8. Two practice sessions followed by critiques were conducted.
9. The experiment proper (Session 2) was then started.

Performance Measure

A total score, consisting of the algebraic summation of scores for downing enemy planes and penalty scores, was computed for each group, for each session. Total scores were based on the following weightings:

1. Downed bomber	+20 points
2. Downed interceptor	−20 points
3. Target bombed	−50 points
4. Friendly planes downed	−20 points

The weightings, though admittedly arbitrary, are based on the relative importance of the factor for the primary mission of the group. The group was informed of the scoring system.

RESULTS

Table 1 presents the total scores by experimental conditions, session, and group. The results of an analysis of variance of these data are shown in Table 2. As the *F* ratios in Table 2 indicate, task load and the interac-

TABLE 1

*Performance Scores by Experimental Conditions, Session, and Group**

Session		Load Condition				
		High			Low	
		1	2		1	2
Sequence:						
Horizontal-Vertical	G_1	18	36	G_9	31	27
	G_2	37	58	G_{10}	50	45
	G_3	7	14	G_{11}	37	15
	G_4	14	23	G_{12}	50	24
Vertical-Horizontal	G_5	21	23	G_{13}	38	52
	G_6	15	19	G_{14}	38	45
	G_7	11	33	G_{15}	45	34
	G_8	23	47	G_{16}	45	22

Note.—The total score was computed as explained in the procedure section. These scores were divided by 10 and a constant of 40 added to eliminate negative values.

* The entries within each cell are for groups, e.g., G_1 is Group 1, G_2 is Group 2, etc.

TABLE 2

Sources of Variance in Group Performance Scores and Their Significance Level

Source of Variance	Sum of Squares	*df*	Variance Estimate	*F* Ratio
1. Load	12.375	1	12.375	$\frac{1}{8}$ = 5.780†
				$\frac{1}{6}$ = 16.655‡
2. Sequence	.195	1	.195	
3. Session	.428	1	.428	
4. Structure	.525	1	.525	
5. Load × Sequence	.946	1	.946	1.273
6. Load × Session	9.790	1	9.790	13.176‡
7. Load × Structure	.691	1	.691	
8. Sub-groups in Sequences	25.690	12	2.141	
9. Error	8.920	12	.743	
10. Total	59.56	31		

* Load was tested using the sub-groups in sequences variance as well as the error variance; the error variance was the suitable error term for the remaining tests.

† Significant at the .05 level or beyond.

‡ Significant at the .01 level or beyond.

TABLE 3

Performance Scores for the Load and Session Conditions*

Session	Load Conditions		
	High	Low	Total
I	146	334	480
II	253	264	517
Total	399	598	

* Each sub-total is the sum of the scores for 8 groups.

tion between load and session were significant. High-load conditions resulted in generally poorer performance as would be expected. However, under high-load conditions performance improved with practice, while under low load the converse was true. The reversal is indicated most clearly in Table 3 where the subtotals for the load × session interaction are presented.

Table 4 presents the subtotals for the load and structure conditions. The vertical structure (differentiation by functions) resulted in poorer performance although the difference is not significant. The interaction between load and structure, of primary interest in this study, is also not significant. Examination of Table 4, however, indicates that a reversal in the relative superiority of the horizontal over the vertical structure

TABLE 4

Performance Scores for the Load and Structure Conditions*

Structure	Load Condition		
	High	Low	Total
Horizontal	198	321	519
Vertical	201	277	478
Total	399	598	

* Each sub-total is the sum of the scores for 8 groups.

occurred under high-load conditions. Thus, although the difference between these is not significant, the horizontal structure was superior under low-load conditions while the vertical structure was superior under high-load conditions.

DISCUSSION

The failure of structure and the structure × load interaction to reach significance casts some doubt on the validity of the assumptions concerning the importance of the structure variables. The complexity and difficulty of the task, though, resulted in a large within-condition variance, and lack of an initial performance matching may have decreased sensitivity to the experimental treatments. In retrospect, it appears that a less complex task which would allow rapid achievement of a criterion level might allow a more adequate test of the treatment.[2]

An unanticipated result of the study was the significant interaction between task load and session. Performance scores from the first to the second session decreased under low load and increased under high load. A general improvement in performance from the first to the second session would be predicted. One possible explanation of such a relationship is that experience under the two load conditions results in a differential "set" toward subsequent task performance. Under low-load conditions groups are relatively effective, perhaps complacent about their ability to handle further problems. The generally poorer initial performance under high load is not so conducive to complacency, and motivation to improve performance may thus be higher under high-load conditions. The relationships have sufficiently important implications for group training problems that further research clarifying the nature of the contingencies is necessary before any conclusions can be drawn.

At a low confidence level, the results also suggest that the effects of a pattern of work distribution on group performance may depend on task demands. There was a tendency for the horizontal structure to be superior

[2] Efforts to develop such a task are being made now.

under low load and for the vertical structure to be superior under high load. Thus specialization, in terms of differentiation of task functions, appears to be relatively more effective when the task load is heavy, while non-specialization is relatively more effective when the task load is light. Despite the tentative results the exploratory nature of the study warrants some speculation concerning this relationship.

It seems apparent that any hypothesis suggested for further test must be based on the characteristics of the task utilized in the study. The most difficult aspect of the task was "tracking" and "plotting" the course of unidentified aircraft. The other primary task activities, deployment of the "interceptor" aircraft, identification of aircraft as friendly or enemy, and keeping account of interceptor fuel status, were less difficult although of equal or greater importance for effective group performance. It is possible that under high load individuals "fixate" on the most difficult aspect of the task, ignoring the less difficult, although equally important, jobs of "deployment" and "identification." Thus, under horizontal structure all three group members may have become overly involved in the plotting and tracking activities to the exclusion of the other functions. With a vertical structure, responsibility for these less difficult activities was accorded a group member, and thus some attention to these functions was assured. The tentative hypothesis may be advanced that, as the difficulty of an element of a task increases, there will be a tendency to fixate on this activity to the exclusion of other less difficult, though equally important, task activities. When such is likely to be the case, it may be advantageous to fix responsibility for these other important activities to insure the groups' attending to those functions.

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Work Group Structure, Communication, and Group Performance[1]

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The primary purpose of this paper is to introduce several constructs which appear to be of general utility in the measurement and analysis of communication in groups. By way of preface, however, in the belief that research on communication processes is most useful when considered in a more comprehensive context, a theoretical framework will be outlined.[2] This conceptualization of the over-all problem of group task performance leads to the study of communications proper by assigning a specific instrumental function to group task-oriented communications.

THE THEORETICAL FRAMEWORK

It should be emphasized that our concern is with teams or groups which have an essential unity of purpose or share certain task directives. A comparatively high degree of prior acquaintance with the task and a substantial body of procedural uniformity are assumed. Finally, attention will be focussed on groups which produce appreciable—and presumably measurable—effects on their surrounding environment. Some of the concepts to be discussed may be applicable to more diffuse or casual social units, but they seem to lose much of their force in the latter case.

Task Performance

It is proposed that in general a task can be represented adequately by a space of multiple dimensions. Each dimension in this space describes some condition of relevance to the welfare of the group or to its productivity as a social unit. In a bomber crew, for example, these dimensions might consist

[1] This article is a revision of a paper presented as part of a symposium on "Communications in Task Oriented Groups" at the American Psychological Association meetings, San Francisco, September 1955. The work was performed in support of ARDC Project 7731 under the Air Force Personnel and Training Research Center, Lackland Air Force Base, Texas. Permission is granted for reproduction, translation, publication, use and disposal in whole and in part by or for the United States Government.

[2] Reference may be made to studies in structure by Bavelas, Leavitt, and others. However, the present work differs from these earlier studies both in conceptual approach and in its immediate objectives. This difference is most clearly manifested in the concern here with input and output characteristics of the task group system.

entirely of readings on the various flight instruments. In other groups the dimensions might measure social relationships, economic conditions, geographical coordinates, and so forth.

The over-all situation of the group with respect to the task environment, at any moment, is represented by a dimensionless point in the task space, and the group's objectives are represented by a target region which also lies within the task space. Locomotion of the representation point within the task space results from response aggregates or sets of behaviors by various agents within the group. Symbolically, it is assumed that any point in the space together with a specified response aggregate determines a new point and that the path of these successive points represents the group's task performance.

Assuming that the group has a pool of alternative response aggregates for potential application at each point, the primary function of task-oriented communication is to contribute to an optimal selection from this pool. That is, effective task-oriented communications will disseminate information in such a way that the response aggregate selected at any instant will place the group as close as possible to the target region in the next instant.

A greatly simplified and exaggerated figure (Fig. 1) will aid in visualizing this process and in deriving the pertinent implications for the present discus-

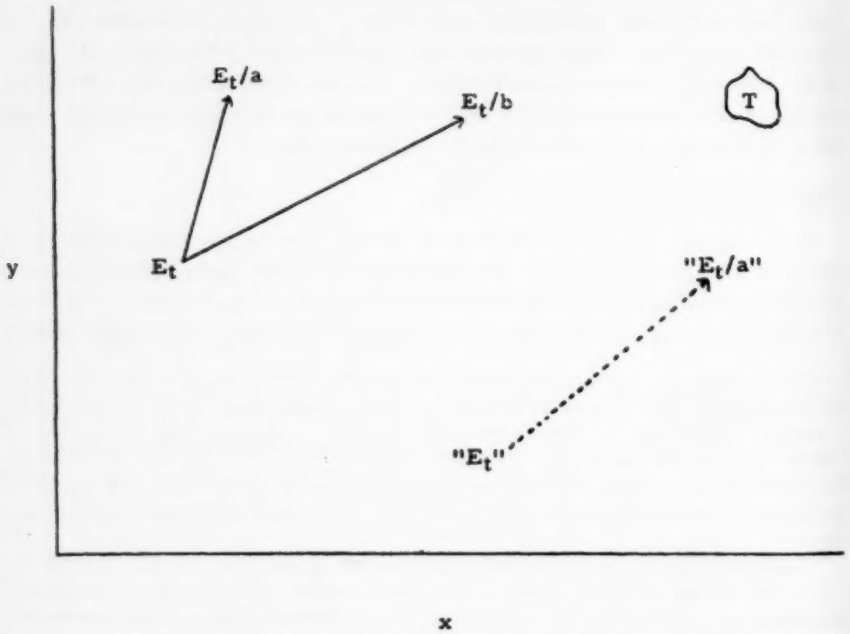

FIGURE 1. A Schematic Illustration of Response Aggregate Selection in a Task Space

sion. The task conditions are represented by variables x and y and the target region by T. The actual starting position of the group at time t is denoted by the point E_t. However, through insufficient information, the group acts as if it were at "E_t". This leads group members to select response aggregate *a* which they believe to have the favorable effect of placing them at "E_t/a". Thus they are led to neglect a more desirable response aggregate *b* for two reasons: first, because they incorrectly assess their starting condition E_t; and second, because they incorrectly evaluate the locomotive potential of response aggregate *a*.

The former factor in the degradation of response selection will be referred to as the *orientation* factor. It implies a faulty appraisal of the situation and, perhaps, additional uncertainty as to the locus of the goal region. The second factor will be designated the *mapping* factor. As the name implies, this refers to uncertainty as to the outcome or result of applying a given response aggregate at any point.

Still a third factor is suggested by the term "response aggregate." If the group's response output at any point is composed of discrete acts (say by different group members) it is likely that these separate acts will differentially alter the group's position with respect to the task variables. If decisions on these separate acts are made independently, however, it is quite possible for the individual decisions to be optimal, from some standpoint, although the total response aggregate selection is very poor. For example, one person may be selecting component responses which maximize progress on the x-axis but lead to regress on the y axis, while another person is doing the reverse. This potential source of degradation will be referred to as the *jurisdiction* factor.

Group Structure

It is evident that the so-called structural characteristics of groups bear an important relationship to these factors in response aggregate selection. In fact, it seems likely that the distribution of responsibilities among group members and the provisions for exchange of information among group members may be fully as critical in this respect as are individual abilities. For the present let us consider one aspect of structure which seems to be related especially to the *orientation* factor. To anticipate somewhat, this requires that we expand our point representation of the group and examine the structural relationships among group members and between the group members and task variables. This expansion takes account of the fact that effective group orientation does not demand complete and uniform orientation of all group members but only the orientation of decision-making persons with respect to relevant dimensions.

Assume that each dimension in the task space is represented by cer-

		R_1	R_2	R_3	R_4	R_5	R_6
	O_1	1	1				
	O_2		1	1			
OR	O_3			1	1		
Matrix	O_4				1	1	
	O_5					1	1
	O_6	1					1

FIGURE 2. Example of an Observation-Response Matrix

tain input observations which may be made by various group members. Presumably, these observations can be categorized in some way which corresponds to the dimensions of the task space or to some simple transformation of these dimensions. Given such a categorization of observations and a classification of control actions, our central assumption is that, for a given system, choice or selection within a given response category is a relatively stable function of the information state within certain defined observation categories.

These functional relationships are indicated by entries in an observation-response (OR) matrix as shown in Figure 2. For example, given a specified observation in categories O_1 and O_6, say a reading on each of two instruments, we assume that a specified response choice is indicated for the control R_1. We hypothesize that these relationships are a function of the task only. That is, groups or individual response agents may choose to ignore some observations but always at the price of degraded response selection.

Turning now to a consideration of group-structure, it will be seen that the responsibilities of individuals can be described in terms very similar to those employed for a task by positing two additional matrices. The first type, a personnel-observation (PO) matrix, indicates the personnel in the group who act as sources of each category of information. The second type, a personnel-response (PR) matrix, shows who is responsible for each category of control action. Examples of these personnel deployment matrices are given in Figure 3 where P_1 is shown to be responsible for O_1 and O_3 and for responses in categories R_1 and R_2.

Now it is possible to calculate from the OR and personnel deployment matrices what the minimum information flow between any two persons should be. It is evident that a person (P) concerned as an agent with a certain control will need to be in communication with all sources of information which are relevant to the choice of adjustments for that control. Thus, in the example, P_2, who is the agent for control R_3, needs information in categories O_2 and O_3. From the PO matrix, it is seen that he is himself a

		O_1	O_2	O_3	O_4	O_5	O_6
PO Matrix	P_1	1		1			
	P_2		1		1		
	P_3					1	1

		P_1	P_2	P_3
PR Matrix	R_1	1		
	R_2	1		
	R_3		1	
	R_4		1	
	R_5			1
	R_6			1

FIGURE 3. Examples of Personnel Deployment Matrices

	P_1	P_2	P_3
P_1	2	2	0
P_2	1	2	1
P_3	1	0	3

FIGURE 4. Example of a Summary Matrix

source of O_2 information, but for O_3 information he depends completely on P_1. Dependencies of this sort between each pair of group members can be easily determined by conventional matrix multiplication procedures. Applied to the OR and deployment matrices of our examples, matrix multiplication produces the matrix shown in Figure 4. In this figure, column headings indicate the response agent who is a user for given categories of observations, and row headings indicate the sources of these observations. For example, P_2 is shown as self-dependent in two linkages, and dependent on P_1 in two linkages.

Although these summary matrices confound some of the facts presented on the PR and PO matrices they convey a good deal of meaning which the deployment matrices do not convey in isolation. They describe the volume of really critical information to be transmitted and provide a succinct, if rough, description of the degree of operator interdependence entailed in a given task and personnel structure. This suggests the working assumption that much of the variance in group effectiveness which can be attributed to structure can be related directly to patterns revealed in these summary matrices.

It remains to characterize the summary matrix in terms which are psychologically meaningful and which represent possible dimensions for experi-

mental manipulation. Only brief examples can be presented here, but they should suffice to illustrate the potential usefulness of this model.

1. *Total entries.* The total number of entries in the OPR matrix is a characteristic closely akin to complexity. The greater the number of different responses which the group must make, and the more information needed for each response, the more complex the task will be.

2. *Main diagonal concentration.* Since entries along the main diagonal represent information autonomously obtained by the response agent, the relative proportion of such entries to total entries may be considered an inverse index of the over-all degree of interdependence among group members.

3. *Row and column variance.* Entries along a row indicate the participation of an individual as a *source* of information while column entries indicate his participation as a *user* of information. Thus variations in row and column totals provide a measure of specialization in functional terms as an observer or a responder. An over-all index of such specializations would be the symmetry of the OPR matrix about the main diagonal.

EXPERIMENTAL STUDIES

In a recent series of laboratory studies we have been investigating the usefulness of some of the notions incorporated in these summary matrices.

The task used requires three subjects to adjust several control switches in response to periodically changing input information. Each of the Ss was seated in a separate booth which prevented visual and direct auditory communication between group members. Each booth contained a standard aircraft interphone circuit with a throat mike and headset, and communication was entirely by means of this circuit.

In every booth there were one or more switches, each having one "off" setting and three "on" positions. Associated with each switch was a table of operating instructions which indicated the correct switch settings for various combinations of instrument readings. Instrument readings were presented visually by either projecting a picture of two simulated aircraft instruments on the front wall of the booth or by placement of the actual instruments within the booth.

The general task set for the group was to process the information presented (instrument readings), relaying the necessary information to the booth requiring it, and to execute the proper control actions based on relayed or directly available instrument readings.

Experimental Manipulations

The principal experimental variations have been in the volume and distribution of information units which must be relayed. In terms of the summary matrices this involves variation in the relative proportion of main diagonal

Structure D		P_1	P_2	P_3
	P_1	3	1	0
	P_2	0	3	1
	P_3	1	0	3
Structure C		P_1	P_2	P_3
	P_1	2	1	1
	P_2	1	2	1
	P_3	1	1	2
Structure B		P_1	P_2	P_3
	P_1	1	2	1
	P_2	1	1	2
	P_3	2	1	1
Structure A		P_1	P_2	P_3
	P_1	0	3	1
	P_2	1	0	3
	P_3	3	1	0

FIGURE 5. Summary Matrices Experimentally Studied

entries and manipulation of the distribution of non-diagonal entries. Figure 5 shows the summary matrices which have been most intensively investigated to date. As can be seen, Structure A requires the relaying of four items of information: Structure B, three; Structure C, two; and Structure D, one. The matrices were reproduced by varying the location of the controls within booths, i.e., changing control nameplates and instruction cards from one booth to another. In terms of our matrix description, the OR and PO matrices remained fixed while the PR matrix varied. However, similar summary matrices could have been generated by varying either the PO or OR matrices.

In addition to structure manipulations we have introduced variations in the input to the group. A differential and varying characteristic of many group tasks is the amount and predictability of the inputs which must be handled. Both the rate of change of instrument readings and the predictability of the locus of a change have been systematically varied.

Findings and Implications

Without describing the results in detail, we believe they justify the statement that, for this sort of task at least, certain communication structures are inherently more difficult than others.

There appears to be a fairly well defined gradient of difficulty increasing

from highly "autonomous" structures, such as Structure D in Figure 5, to structures requiring maximum information relay, such as Structure A in Figure 5. Moreover, differential performance on these structures is maintained over the entire range of input variations and degrees of training that we have explored.

In addition to this primary finding, an examination of records for individual controls indicates that the dispersal of information bearing on a particular control may be as critical a factor as the sheer amount of information that must be relayed. That is, where several pieces of information must be obtained to operate a given control, it is generally more effective if the information can be obtained from a single source.

The latter finding in particular indicates that the limiting factor in the performance of our groups is not the gross information capacity of our communication system. In fact, the maximum input rate we have given our groups does not exceed 30 bits/min. Rather, the difficulty seems to lie in the inability of groups to set up an efficient system for phasing or actuating messages. In concrete terms, response agents do not know when information bearing on their controls enters the group at some other station; and information source persons are not sure of the relevance of new information they receive. Although this interpretation is based largely on informal observations of the performance, we are currently obtaining communication records from which we hope to glean more decisive evidence.

DISCUSSION

It may not be inappropriate to indicate briefly the way in which we suspect these results will extend to a wider class of tasks. First, it seems likely that most group tasks permit considerably greater freedom in personnel deployment than does our laboratory task. In most "real life" tasks there is quite a bit of latitude with respect to who shall make various observations and who shall be responsible for various control actions even though there may be some physical constraints. For such tasks the arterial communication pattern is to a large extent arbitrary or subject to modification by group members. Hence we should hypothesize that, other things being equal, those groups which deploy their personnel so that a minimum of relayed information links are required in the arterial communication patterns, will exhibit the best performance. A second hypothesis suggested by our results is that, other things being equal, those groups in which the actual information flow most closely corresponds to the arterial communication patterns, whatever they are, will exhibit the best performance. Both these hypotheses are clearly testable and, for the latter hypothesis, at least, we have already obtained some corroborative evidence based on the performance of B-29 crews.

These hypotheses illustrate the general direction in which our current research and thinking is going. We believe that, with further refinement, principles of the sort suggested here may have rather wide applicability in the study of communication in groups.

It should not be overlooked, however, that these considerations and the background research are based almost exclusively on the single factor of task space *orientation*. In the experiments described, for example, groups are told what response or control actions should be made at a given point so that the *mapping* problem *per se* does not exist. Also, since performance scores are simple totals of separate response errors, the *jurisdiction* factor is nonexistent.

It is not difficult to supply counter-examples which dramatically violate considerations of optimum mapping and jurisdiction even though they fully conform to the requirements for adequate orientation. An artillery squad in which each member fired on an *ad libitum* basis would be a case in point. Even if each man could see the enemy, he would have no way of knowing where his shells were falling and the fire pattern would tend to be ineffective. Although this is extreme, it is evident that single principles—even as broad as those connected with the orientation factor—should not be overworked.

More to the point of our present discussion, however, is the implied relationship between a specific and operationally applicable model of group communication and some more ambitious framework for describing the over-all performance problem. It is suggested that we need the broader theorizing, *initially* to define areas within which miniature system construction makes sense and *later* to act as a check on any recommendation or conclusions we may base on the miniature system analysis. Granting that a satisfactory solution of the more general problem of performance must await real progress in subsidiary areas, it should be stressed that those subsidiary areas can only be demarcated and evaluated by the uncertain light of some broader schema.

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Social Status and the Personality Adjustment of the Child[1]

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Over the years there has been a great deal of interest in the influence of social status on personality. This has led to a considerable body of published research (1, 2, 4, 5, 9, 10, 13, 24, 25, 26, 27, 34, 35, 36, 37, 45, 48, 50, 52, 53, 55, 57, 60, 61, 64, 65, 66, 67, 68, 74). The results of most of the more rigorous studies were evaluated by Auld in 1952 (2). In this evaluation three criteria were established to determine the adequacy of the studies to provide warranted conclusions concerning the influence of status on personality. These were: 1. that status be measured by the use of an acceptable measure, 2. that the sample represent a wide range of status, and 3. that a stable measured relationship be found between status and one or more of the existing objective tests of personality. Most of the researches examined were found to be deficient in one or more of these aspects, but those meeting the minimum standards generally concluded that there was a low but positive relationship between status and measured personality adjustment. It was particularly clear that the personality test performance of middle-class children was significantly higher than that of lower-class children (1, 4, 34, 45, 50, 66, 67, 74).

The present writers have examined these studies, and a number of others not included in the review, and believe that no sufficiently rigorously designed research has yet been reported to warrant the conclusion that the relationship between status and personality adjustment has been clearly established. The particular weaknesses found, even in the studies which meet Auld's criteria, are two: 1. failure to control the personality adjustment effects of variables known to be correlated with status, and 2. failure to test the relationship in samples drawn to represent the full range of status levels in a relatively homogeneous and definable social system. Thus, some studies have been based on comparisons between one of the lower and one of the higher status groups in a community, or between persons of low status in a minority group and high status persons in the dominant ethnic group,

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or even between a low status group in one community and a high status group in another community. Obviously, comparisons of these kinds tend to exaggerate any possible existing relationships.

The aim of the present study is to test the hypothesis of a relationship between status and measured personality adjustment in a research context which satisfies not only Auld's conditions but also the conditions reflected in the above criticisms. In the opinion of the writers, the fulfillment of these conditions provides an appropriate test of the hypothesis. The statistical hypothesis tested is: *In a culturally homogeneous social system there is no significant correlation between the social status of the child's family and his measured personality adjustment when their mutual relationship to selected variables is controlled.* If the null hypothesis is found to be correct, it may be concluded that there probably is no fundamental relationship between status and measured personality adjustment. If the contrary occurs, it may be concluded that there probably is a true relationship between the two variables and the sources, dimensions, and consequences of this relationship may be explored with profit.

RESEARCH DESIGN

The social system under investigation is a Wisconsin community which is composed of a small urban center (Richland Center, population approximately 5,000) and its satellite rural-nonfarm and farm populations, the outer limits of which are adequately described by the legal boundaries of Richland County. The community is primarily Old American in ethnic background. Its main industry is farming, centered around dairying, and most of its population is directly or indirectly dependent on agriculture. However, there is a full range of occupations to be found in the community, reflecting the diversity of status levels in the social system. The community is relatively isolated from any large urban concentration, which fact helps to maintain its cultural homogeneity.

The subjects selected for study are all of the children of the fourth through the eighth grades, in both the public and the parochial schools. The decision to use the school population was dictated by the need for a group upon which testing was practicable. In all, 1,462 children were included in the study.

The data gathered on each child are of three types: 1. scores on The California Test of Personality—Elementary, Form A (70), 2. scores on The New California Test of Mental Maturity—Elementary 47-S Form (71), and 3. information from a family background questionnaire which was filled out by the teachers from school records and from personal knowledge of the families.

The dependent variable of the study was taken from the test of person-

ality adjustment. Specifically, the twelve subtests of which the test is composed were intercorrelated and the first principal component, extracted by the Hotelling method (38), was indexed following Hagood and Price (29). Only the factor-weighted total score (which, incidentally, correlates very highly with the unweighted score) was used as the dependent variable. It is called the "personality adjustment score." Thus, the internal factorial analysis of the test must be taken along with the item analysis (performed by the California Test Bureau) and the general acceptance of the test in the literature as evidence of its validity (7, 39, 40, 72).

The independent variables of the study are, of course, status factors. The child's father's occupational rating and the prestige rating of the child's family in the community were selected as status indicators. Both were taken from the family background questionnaires filled out by the teachers. The occupations of the fathers were coded using a six-point scale based on the Sewell-Ellenbogen modification of Edwards' socioeconomic classification of occupations (20, 63). The prestige rating of the child's family in the community was coded into one of five ranked categories. These were given values of one through five. Each of the two status variables was treated separately in the analysis due to their relatively low correlation ($r = +.32$) and in order to assess their individual contributions to the measured personality adjustment variation.

These two indicators are among the most commonly accepted criteria of social status. Evidence from a number of studies indicates that occupational position correlates highly with several other indexes of status, and social scientists generally have been willing to accept it as a valid measure of status (8, 18, 19, 30, 41). Prestige ratings of the family have been widely used to tap another important dimension of status—particularly in studies of smaller communities where the prestige position of the family is generally known and is very important in local affairs (18, 19, 42, 43, 62, 73).

Table 1 presents the specific breakdown of the two dimensions. While the status extremes are by no means striking, it is evident that the requirement of a wide status range is met by these data. Children of local business and professional families are present in sizeable numbers, the highest stratum, and those of relatively unskilled laborers are present in appreciable numbers, the two lower strata. A similar situation obtains in the family prestige dimension: sizeable numbers of children from families of all prestige levels are present.

The final condition for a rigorous test of the hypothesis of no association between measured personality adjustment and status is the control of variables related to status which, if also related to adjustment, might spuriously increase the apparent relationship between adjustment and status. Three such control variables were selected. They are the number of siblings in the

TABLE 1

*Social Status of Children**

Status Variable	Status Position	Percent
A. *Child's Father's Occupational Rating*	I. Business owners and professional persons	9.5
	II. White collar workers, clerical workers, and skilled tradesmen	14.5
	III. Farm owners	38.6
	IV. Farm tenants	20.3
	V. Semi-skilled and unskilled workers	15.5
	VI. Farm laborers	1.6
	Total	100.0
B. *Prestige Rating of the Child's Family in the Community*	I. High	10.9
	II. Medium high	15.9
	III. Average	57.8
	IV. Medium low	12.4
	V. Low	2.9
	Total	99.9

* Number of subjects: 1462.

child's family, the child's chronological age, and the child's intelligence quotient. These were chosen because there are either theoretical or practical reasons for believing that each is related to status and to personality adjustment. The size of the child's sibgroup was selected due to its often hypothesized relationship to adjustment and its known relationship to status (3, 12, 16, 21, 33, 46, 54, 56). The chronological age of the child was selected because it was found to be related to adjustment (see Table 2) and because it was reasoned that low status children are more likely to be older due to failing grades than are high status children. Intelligence was selected because it was found to be associated with adjustment (see Table 2) and because it is known to be related to status (6, 11, 17, 28, 31, 47, 58, 59, 63, 69). Other variables might have been selected, yet the control of these three provides a more thorough test of the hypothesis than has been possible to date.

In the ensuing analysis the following symbols will be used to identify the variables: X_1—the child's personality adjustment score; X_2—the child's father's occupational rating; X_3—the prestige position of the child's family in the community; X_4—the number of children in the child's family; X_5—the child's age in months; and X_6—the child's intelligence quotient. Again,

TABLE 2

*Zero-Order Correlation Coefficients**

	X_1	X_2	X_3	X_4	X_5	X_6
X_1	—	+.159	+.231	−.118	+.121	+.124
X_2	+.159	—	+.318	−.167	−.044	+.169
X_3	+.231	+.318	—	−.208	−.032	+.134
X_4	−.118	−.167	−.208	—	+.140	−.083
X_5	+.121	−.044	−.032	+.140	—	−.224
X_6	+.124	+.169	+.134	−.083	−.224	—

* $r \geq \pm .06 = P \leq .05$.

X_1: Child's personality adjustment score

X_2: Child's father's occupational rating

X_3: Prestige status of the child's family in the community

X_4: Number of siblings in child's family

X_5: Child's chronological age

X_6: Child's intelligence quotient

X_1 is the dependent variable, X_2 and X_3 are the independent variables, and X_4, X_5 and X_6 are the control variables.

RESULTS

The hypothesis of no relationship between status and measured personality adjustment was tested in two phases. The first phase concerns the zero-order correlation and the first-order multiple correlation between the two status variables and measured personality adjustment. The second phase concerns the controlled analysis.[2]

The zero-order correlations of the status variables with the index of personality adjustment were found to be positive. As Table 2 shows, these are $r_{12} = +.159$ and $r_{13} = +.231$. Furthermore, given the size of the sample, the correlation coefficients are large enough to be significant beyond the .001 level (the child's personality adjustment score, X_1, and child's father's occupational rating, X_2: $F_{0(1,\infty)} = 34.90 > F_{t(1,\infty).001} = 10.83$; the child's personality adjustment score, X_1, and the prestige position of the child's family in the community, X_3: $F_{0(1,\infty)} = 79.81 > F_{t(1,\infty).001} = 10.83$) (51). This evidence of a significant and positive zero-order relationship of status to measured personality adjustment is in agreement with previous research. It will be noticed, however, that the amount of relationship, as measured by the zero-order correlation coefficients, is low ($r_{12} = +.159$ and $r_{13} =$

[2] The statistical techniques used in the study are based upon assumptions about the nature of the data. Specifically, the variables should be quantitative, normally distributed, homoscedastic, and have a linear relationship to each other. As is generally the case in research, none of these is perfectly met. Nevertheless, the authors believe that the data are close enough to the assumptions of the techniques to be applicable in this instance.

+.231). The first-order multiple effects of the two status variables, X_2 and X_3, on personality adjustment, X_1, are also low ($R_{1.23} = +.249$). This finding may indicate that status is not as important an influence upon measured personality adjustment as has been assumed in much of the social-psychological literature (14, 15, 22, 32, 49). Nevertheless, the correlation coefficients clearly demonstrate that status and the index of personality adjustment are significantly related when the influence of non-status variables is not controlled.

The controlled test of the hypothesis, carried out by means of a multiple correlation analysis, is more complex (23, 29, 51). If the variables that have been found to be related to measured personality adjustment and status, but which are neither personality adjustment nor status in themselves, could be shown to account for their apparent relationship, then it could be concluded that the observed relationship is spurious. The test was made by comparing the personality adjustment score (X_1) variance accounted for by the combined effects of the child's father's occupational rating (X_2), the prestige position of the child's family in the community (X_3), and all control variables (X_4, X_5 and X_6), with the personality adjustment score (X_1) variance accounted for by the control variables (X_4, X_5 and X_6) alone. If the control variables alone could account for an amount of variance not significantly different from the amount accounted for by all variables, then the hypothesis of no relationship would be accepted. In the present study, $R^2_{1.23456} = .098$, while $R^2_{1.456} = .052$. The difference between these two variances yields an F ratio significant beyond the .001 level ($F_{0(2,\infty)} = 21.93 > F_{t\,(2,\infty).001} = 6.91$) (44). Thus, it is clear that the control of sib-group size, chronological age, and intelligence does not account for enough of the measured personality adjustment variance associated with the status variables to require accepting the hypothesis of no relationship.[3] Therefore, it is concluded that in the group studied the measured personality adjustment of the child must be at least in part a function of the social status of his family.

DISCUSSION

From the results of this study it is clear that in the culturally homogeneous community in which this research was conducted there is a significant relationship between the social status of the child's family and his

[3] The zero-order personality adjustment effects of each status variable were compared with the combined effects of both in order to discover whether the variance apparently due to both could be shown to be due to only one. (1) $R^2_{1.23} = r^2_{12}{:}F_{0(1,\infty)} = 52.15 > F_{t(1,\infty).001} = 10.83$. (2) $R^2_{1.23} = r^2_{13}{:}F_{0(1,\infty)} = 12.68 > F_{t(1,\infty).001} = 10.83$. Similarly, when the control variables are added, (3) $R^2_{1.23456} = R^2_{1.2456}{:}F_{0(1,\infty)} = 40.94 > F_{t(1,\infty).001} = 10.83$; and, (4) $R^2_{1.23456} = R^2_{1.2456}{:}F_{0(1,\infty)} = 7.31 > F_{t(1,\infty).01} = 6.64$. Thus, each status variable makes a somewhat unique contribution to the explanation of the personality adjustment score variance.

measured personality adjustment. This relationship is maintained even when variables known to be related either to status or personality or both are controlled. However, the magnitude of the relationship is so small that it contributes relatively little to the explanation of the variance in measured personality found in this group of school children. If this is an accurate estimate of the amount of relationship to be found in other samples, the conclusion would be that the general importance of status to personality is not as great as has been commonly assumed.

The writers are not ready to take this unequivocal position even though most of the evidence in the literature leads to the same conclusion (5, 26, 57, 66, 74). This is because it is felt that the tests made may understate the relationship for other populations. It is entirely possible that in more complex social systems than those studied so far, with greater differences in social strata and with more definite stratification systems, social status may produce more marked effects on measured personality adjustment than have been found to date. Moreover, it is possible that the effects of status on personality adjustment may be more marked in other age groups than the one included in this study—particularly adolescents. Finally, it must be pointed out too that the measures used for assessing both status and personality adjustment in this and other quantitative studies are at best crude and, consequently, the correlations found may understate the relationship between status and personality adjustment. However, this question can only be answered by field studies using better measures than those available for use in the present investigation. In any event, in light of the low correlations found in this and previously published studies, it would seem advisable for social scientists to pursue research into the nature and extent of this relationship in other social systems before making any sweeping generalization about the importance of social status to personality adjustment.[4]

SUMMARY

A test was made of the hypothesis that in a culturally homogeneous social system there is no significant correlation between the social status of the child's family and his measured personality adjustment when their mutual relationship to selected variables is controlled. The study was conducted in a Wisconsin community which was shown to be culturally homogeneous but to have a wide range of status levels. All children in grades four through eight in the community were included in the study. The dependent variable

[4] Further analysis of the data used in the present study suggests that at least part of the relationship of personality adjustment to status is due to the lower status child's perception of his low status and the consequent development of a personality maladjustment factor tentatively identified as status anxiety. (It is anticipated that the results of this study will be published in full at a later date.)

of the study was X_1—the child's personality adjustment score as measured by a factor-weighted test of personality. The independent variables were two indicators of social status: X_2—the child's father's occupational rating, and X_3—prestige rating of the child's family in the community. The control variables were: X_4—the number of siblings in the child's family, X_5—the child's chronological age, and X_6—the child's intelligence quotient. Zero-order correlations between the two status measures and measured personality adjustment were found to be low but positive and significant. When the effects of the remaining variables were controlled, there was still a low positive but significant relation between the status variables and measured personality adjustment. Therefore the hypothesis of no relationship was rejected. It was pointed out that the results of the present study may understate the degree of the relationship which exists in the group studied because of the crudeness of the available measurements. It was also indicated that the relationship between the status of the child's family and his measured personality may be greater in communities in which there is less cultural homogeneity and a broader and more complex stratification system. However, it was argued that carefully designed research in other social systems should be undertaken before further generalizations are made about the importance of social status to personality adjustment.

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Weights Assigned by Children to Criteria of Prestige[1]

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This study is concerned with children's conceptions of a general stratification system based upon the prestige associated with occupational positions. Research on the patterns of adult evaluation has revealed considerable consensus as to the relative prestige of many occupations. It may be assumed that consensus in evaluation is the product of a common learning process. However, it is insufficient to point only to a common learning process as an explanatory factor. The content of this process must be examined if its relationship to evaluation is to be understood. By internalizing this content and learning to respond to the conception of a general hierarchy, the individual is learning a role; that of an ascriber of prestige. The purpose of this study is to investigate one aspect of the development of that role.

Prestige, as defined in this study, is multi-dimensional. Following Hatt's usage (4), some combination of all the rewards and prerequisites of a position constitutes its invidious value and hence its prestige. Thus these rewards and prerequisites serve as criteria of prestige and are of special interest here. From a survey of the literature on stratification, seven such criteria have been isolated. They are the income, education, working conditions, fame, community service, authority, and scarcity of personnel associated with a given occupation.

Two functions are performed by the ascriber in the evaluation of occupational prestige:

1. The ascriber must estimate the amount or increment of each of the criteria associated with a given occupation.
2. The ascriber must weight each criterion in accordance with its importance in his own value system.

Thus variation in prestige ratings can come about in two ways. First, there may be differences among ascribers as to the increment of any criterion associated with an occupation. For example, two ascribers could have quite different conceptions as to the amount of authority invested in a shop foreman. Second, the weights assigned to each criterion might not be the same for every group of ascribers. Income might have greater invidious value for

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persons of lower socio-economic status than for those of higher status. Therefore, within this conceptual framework, a general prestige evaluation would consist of the weighted rather than simple sum of the rankings on each of seven criteria.

An attempt is made to determine the relative weights children assign to prestige criteria. Of the matrix of factors related to these weights, two have been selected for analysis in this study. (a) By systematically varying age, it is hoped that developmental patterns in the importance children accord specific criteria may be discovered. (b) The studies of Centers, Davis, Hatt, Hyman, and others (1, 3, 4, 5) have indicated that one's position in the stratification system has important consequences for the way that system is perceived. Similar studies have revealed striking differences between the value systems of social classes. By varying status level, it may be possible to determine the extent to which these differentials at the adult level are reflected in the responses of the children.

METHOD

Sample. The elementary school population of the Chicago Public School System constituted the universe from which the sample was drawn. Status level was systematically varied by stratifying schools, selecting schools most representative of the characteristics defining each stratum, and then randomly sampling within the selected schools. The status level of each school was defined in terms of the ecological characteristics of the area from which it draws its students. Using census tract data on income and education, an index was devised to measure the status level of each area.[2] The schools were then arrayed on the basis of this index, the range computed, and divided in three. The schools were selected as representative of the Upper, Upper-Middle, Lower-Middle and Lower status levels, respectively.

Six white male students were drawn from each of the fourth, sixth, and eighth grades within the selected schools. These grades correspond roughly to ages nine, eleven, and thirteen. White males were selected to avoid the effect of uncontrolled variation due to race and sex. Thus six students were selected from each of three grades at four schools making a total of seventy-two cases in all.

Interview. An interview schedule was designed to measure the relative weight a respondent assigns to each of the seven criteria. On each item, the respondent must rate the relative importance of two different prestige criteria. For example, "Which do you think is more important, a job which pays more or a job which takes more education?" Each criterion was com-

[2] Median family income and median school years completed for population 25 years and older were used in constructing the index. They were combined by means of conversion to standard scores.

TABLE 1

Distribution of Weights Assigned to Income by Grade and Status

Grade Level	Status Level				
	U	UM	LM	L	Total
8	1 0 1 2 1 0	2 0 1 0 3 4	2 4 4 2 2 6	5 5 5 5 5 6	66
6	0 0 1 2 1 0	2 3 2 0 2 2	3 2 3 3 5 4	5 3 4 4 6 6	63
4	0 0 0 0 1 0	3 3 1 3 3 3	2 2 2 3 2 3	5 4 2 4 5 6	57
Total	10	37	54	85	

Source of Variation	Analysis of Variance			
	Sum of Squares	Degrees of Freedom	Mean Square	*F* Ratio
Total	241.5	71		
Subclasses	177.5	11		
Statuses	164.5	3	54.8	*51.2*
Grades	2.4	2	1.2	1.1
Interaction	10.7	6	1.8	1.8
Error	64.0	60	1.1	

pared with every other criterion once, making a total of twenty-one such paired comparisons. It was possible for any criterion to be rated higher than other criteria from zero to six times. By defining the relative weight of any criterion as the frequency of preference, a seven point scale was derived.

Method of Analysis. The results of the paired comparisons test were incorporated into analysis of variance designs; one for each prestige criterion. A check was made to insure that the techniques used in application met the assumptions of this method.[3] The purpose of these designs was to test whether the variables of grade and status level were related to the importance assigned prestige criteria. A sample analysis for the criterion of income appears as Table 1.

[3] There was some departure from normality among subclass distributions. However, this does not seriously affect the derived probability values. Bartlett's tests revealed no significant differences among subclass variances.

TABLE 2

Results of Analyses of Variance of Weights Assigned to Prestige Criteria

Criterion	Variable	Degrees of Freedom	*F* Ratio
Income	Status	3	*51.2*
	Grade	2	1.1
	Interaction	6	1.8
Education	Status	3	*9.1*
	Grade	2	1.3
	Interaction	6	.1
Working Conditions	Status	3	*28.8*
	Grade	2	1.7
	Interaction	6	.3
Fame	Status	3	*8.4*
	Grade	2	*17.4*
	Interaction	6	1.0
Community Service	Status	3	1.4
	Grade	2	.3
	Interaction	6	1.0
Authority	Status	3	7.7
	Grade	2	*3.8*
	Interaction	6	.7
Scarcity	Status	3	3.0*
	Grade	2	2.9*
	Interaction	6	*5.6*

Note: With 60 degrees of freedom for the error mean square, all italicized values are significant at the .05 level.

* Interaction mean square used as denominator of *F* ratio.

RESULTS

The results of the seven analyses of variance appear as Table 2. Whenever the magnitude of the *F* ratio indicated a significant relationship between one of the variables (status, grade, or the interaction between the two) and the weights assigned to a particular criterion, the direction of that relationship was explored by means of *t*-tests. Below are the results of these further analyses.

Income. Significant differences were found between the status groups in the importance they accorded income. As status level increased, the weights

* The respective means are 2.1 and 3.0. With 34 degrees of freedom, $t = 3.06$; p less than .05. The results of tests reported for all other criteria satisfy this level.

assigned to income decreased. The smallest difference, that between the two middle groups, was significant, indicating significance for the entire progression.[4] The studies of Centers and Cantril (2), the National Opinion Research Center (6), and others, indicate greater concern with, and a higher value placed upon, material rewards by lower status groups. These patterns at the adult level, operating through the mechanisms of socialization, may be producing similar patterns of evaluation in children. Table 2 shows the other variables to be non-significant.

Education. Because of the necessity of education for mobility and/or status maintenance in the Upper and Upper-Middle groups, it might be expected that children from these groups would assign higher weight to this criterion. On the other hand, economic pressures militate against the availability of education as a mobility channel for members of the Lower status group. It would be less likely that their children would accord great importance to this factor. Education is desirable for but not necessary to status maintenance in the Lower-Middle group. It might be expected that children in this group would fall between the Lower and two Upper groups. As indicated by *t*-tests, this was the case.

Working Conditions. As in the case of most other criteria, the important contrast in the weights assigned to working conditions was between the two Upper and two Lower groups. The difference between the combined means was significant. Factors such as dress, cleanliness of work, control over working time, may be of secondary importance in the probable future occupational roles of children in the Lower groups. This may be reflected in their low frequency of preference for this criterion. Conversely, working conditions are part of the definition of the occupational sub-culture in the Upper and Upper-Middle groups. It might be expected that their children would place higher value on the criterion.

Fame. Table 2 shows both status and grade to be related to the weights assigned to fame. There is a clearly defined progression in the importance assigned to fame at each grade level, ratings being highest in the fourth grade, lowest in the eighth. One way of interpreting this pattern would hold that fame's connotations of adventure and individual glory would have greater appeal for the egocentricity of younger children; as they grow older and there is a reduction in egocentric perspective, this appeal diminishes. The distribution of weights by status level was opposite to that found for working conditions, fame having significantly more appeal for Lower and Lower-Middle status children. The type of public adulation connoted by fame may not be given as much emphasis as recognition for professional achievement by those in the professions and similar occupations. On the other hand, becoming famous, with its implications for economic reward and personal gratification may be equated with success by those in Lower status groups and hence evaluated more highly.

Community Service. The results for this criterion were all nonsignificant, scores being uniformly high for all groups. It is likely that helping to serve the community had considerable appeal on a moral basis. "Helping" is good, and as such it should be regarded as important.

Authority. Both grade and status level were related to the weights assigned to authority. Authority held significantly more appeal for students in the sixth and eighth grades than for those in the fourth grade. By the sixth grade, the meaning of authority changes from one implying purely power to one implying increased ability and personal responsibility. Having authority was given significantly more emphasis by Lower and Lower-Middle status children. It may not be power over others but control over one's own decisions that is emphasized in the two Upper groups. If this is the case, authority *per se* would not be of great importance to them. On the other hand, the parents of children in the Lower groups are often dependent upon persons in authority positions for their means of livelihood. The concept of being "boss" may be considerably more important in the lives of these children.

Scarcity. Analysis of variance showed that variation in the weights assigned to scarcity was due to the interaction of the factors of grade and status level. What appeared to be happening was that the interpretation placed on the criterion was related to grade; the evaluation related to status. Younger children tended to give romantic interpretations; older children saw implications of formal skills and limited opportunities. A *t*-test indicated that younger Lower and Lower-Middle and older Upper and Upper-Middle status students gave this criterion more weight than the remainder of the students in the sample.

CONCLUSIONS

These findings support the conclusion that patterns of occupational evaluation found in adult status level sub-cultures are reflected in the ways children perceive the status structure and function as ascribers of prestige. Generally, criteria implying material rewards are given more emphasis by children from Lower or Lower-Middle status backgrounds; criteria implying psychic rewards, extensive prerequisites, and personal ability are given greater weight by Upper and Upper-Middle status students. Developmental factors appear to be operating in the weights assigned to several of the criteria. In the case of authority and scarcity, these factors seemed to influence the way in which the child would interpret the criterion. In the case of fame, they appeared to reflect differentials in egocentricity.

Some consideration should be given to the limits of generalizability of these conclusions. The probability values for the various statistics used refer to a sample of Chicago Public School students. It is to this group that these conclusions are directly relevant. However, insofar as these data are

consistent with the findings of many researchers in the area of social stratification, they may be in part independent of local idiosyncrasy. To this extent, it is hoped that they may be suggestive for further study of the development of ascription behavior in mass society.

SUMMARY

The purpose of this study was to determine the relative weights children assign to various criteria of occupational prestige, and to assess the effect of their status background and grade level upon these weights. Through the analysis of variance of children's responses to a paired comparisons test, the following relationships were found:

1. The child's status level was related to the weights assigned to income, education, working conditions, fame, and authority. For income, fame and authority, the weights assigned to the criteria increased as status level decreased. The direction of the relationship was opposite for education and working conditions.

2. The child's grade level was related to the weights assigned to fame and authority. As grade increased, the importance given fame diminished; that accorded to authority increased.

3. The interaction of the two variables was related to the weights assigned to scarcity. Older Upper and Upper-Middle, and younger Lower and Lower-Middle status students gave this criterion the greatest weight.

These directional patterns were generally congruent with those found in adult ascription behavior.

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Housing Architecture and Social Interaction[1]

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PROBLEM

Granted that personal and social adjustments are influenced by living arrangements, relationships between internal differences in the architecture of military barracks and social interactions among occupants are investigated in the present study. The assumption is that closed as contrasted with open cubicle living arrangements lessen the interaction among occupants of the barracks as a whole. If the assumption is valid, then the development of acquaintances and friendships outside of the closed cubicle is decreased and interaction is higher among occupants of one's own cubicle.

The general hypothesis that living or working space arrangements condition interactions that occur among participants has been validated in other situations. Festinger, Schachter, and Back (3) and Byrne and Buehler (2) have demonstrated that the frequency of friendships increases with decreased spatial proximity of participants living in a housing development and of seating arrangements in a classroom. The introduction of barriers enclosing sub-units within a larger group also has been shown to have a psychological effect on interaction comparable with that of increasing the physical proximity of participants located within a common work area. Evidence supplied by Gullahorn (4) for an office situation demonstrates that interaction among office personnel is significantly decreased by the presence of filing cabinets separating rows or sub-groups but that interaction within sub-units is increased. That barriers like walls can decrease interaction with others who are located beyond them and increase it with those who are enclosed is consistent with the evidence furnished by the investigations referred to above. Wall barriers should effectively decrease possibilities for interaction and, therefore, effect the emergence of relationships with others located outside the walls but living within a common barracks space.

The hypotheses tested are that by comparison with open cubicles, and

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with other factors held constant, living in closed cubicles is associated with (1) smaller average acquaintance volume, (2) less knowledge of bunk locations of other occupants, (3) a higher ratio of interactions within than between cubicles and (4) a higher ratio of "buddy" preferences within than between cubicles. Confirmation of these hypotheses would demonstrate that closed as contrasted with open living arrangements restrict interaction among the occupants of the barracks as a whole and increase it between personnel living within the same cubicle.

DESCRIPTION OF THE STUDY

Selection of Barracks

Data were collected from three open and three closed cubicle barracks located at Sampson Air Force Base in September, 1955. In both types of barracks bunks were segregated into units of six each. The only difference is that the closed cubicle barracks had walls enclosing each unit of six bunks, with entrances from which doors had been removed. No special rules restricting movement from one cubicle to another were in force in either type of barracks. Each housed approximately 60 recruits who were assigned randomly to open or closed cubicle type barracks. Occupants of matched barracks were undergoing a training program standardized in all aspects such as curriculum content, other scheduled activities, clothing, amount of available free time, etc. The three pairs of matched barracks selected for study had completed the 6th, 11th, and 14th days of training respectively. Data from matched pairs were collected at the same time in a single testing room, thus permitting standardization of testing conditions. Due to absence from testing of some recruits from each barracks the analysis is based on responses by a total of 164 recruits living in open and 169 living in closed cubicle type barracks.

Interaction Questionnaire and Administration

Recruits were provided with a map showing cubicle arrangements, with instructions to identify all men living in their barracks. The form for open and closed cubicle types was the same in all details, except that dotted rather than solid lines were used to designate cubicles in open barracks.

Names were written within each cubicle, thus permitting the respondent to indicate the location of bunks assigned to the other men. If a man's name was known but his specific bunk location was not, his name was recorded on an accompanying list. When formal names were unknown, identification by nickname was allowed. In order to match formal names with nicknames, each respondent also indicated the additional names by which he was called.

Every respondent supplied the following information for names on both

the map and list: (1) the degree to which they interacted during free periods, on a 4 point scale from "seldom or never spend time with him," to "spend most of my spare time with him;" and (2) the identity of the three men with whom each man preferred to "buddy." A question concerning the extent of the respondent's acquaintance with others prior to barracks assignment, with ratings on a 5 point scale from "have been a life-long friend," to "no acquaintance prior to barracks assignment," was introduced for control purposes. No significant differences between open and closed type barracks in the frequency of acquaintanceship among occupants prior to recruitment were found.

RESULTS

The first section provides a comparison between pairs of matched barracks, relating cubicle type to acquaintance volume. The prediction is that acquaintance volume is higher in open than in closed cubicle type barracks. The second contrasts knowledge of specific bunk locations of acquaintances to test the hypothesis that correct knowledge is higher in open than in closed types. For both parts the analysis is in terms of the number of correct identifications given by each respondent in filling out the map or list. The third section compares the amount of interaction with others in the same cubicle to the amount that takes place with others living in different cubicles, with the prediction from the third hypothesis of a higher frequency of interaction taking place within cubicles for the closed type of barracks. The fourth section evaluates the frequency of "buddy" preferences from within as compared with outside the respondent's own cubicle with the same prediction as above for differences between cubicle type and frequency of interaction.

Acquaintance Volume

Table 1 gives averages for total acquaintance volume with separate distributions for knowledge of bunk locations of acquaintances (map) and acquaintances with bunk locations unknown (list), as a function of type of barracks. For pairs of barracks whose occupants are in the 6th and 14th days of training and for massed data, a significantly larger ($\alpha = .01$, t test) number of correct identifications (map and list combined) were made by those in open than in closed types. The difference for the 11th day of training is not significant, but the trend is in the same direction. Since other factors that might account for the obtained differences were held constant in designing the study, the results are interpreted as due to the architectural feature involving open versus closed cubicles. Closed cubicle living arrangements are associated with the development of a smaller number of acquaintances.

TABLE 1

Average Choices Given for Total Acquaintances Known and for Knowledge of Bunk Locations of Acquaintances as a Function of Open vs. Closed Cubicle Type Barracks

Day of Training	Barracks Type	Bunk Location Known	Bunk Location Unknown	Total Acquaintances
6	Open	18	12	30
	Closed	9	14	23
11	Open	15	11	26
	Closed	14	11	25
14	Open	23	13	36
	Closed	15	13	28
Total	Open	19	12	31
	Closed	13	12	25

TABLE 2

Frequency of Within and Outside Cubicle Interaction as a Function of Open vs. Closed Cubicle Type Barracks

Day of Training	"Spend most of spare time with"				"Spend some of spare time with"				"Spend occasional spare time with"				"Seldom spend time with"			
	Open		Closed		Open		Closed		Open		Closed		Open		Closed	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
6	97	122	98	21	78	230	78	70	32	329	57	262	40	730	15	611
11	27	45	85	55	29	111	57	109	35	322	50	307	61	625	42	675
14	56	64	90	52	55	118	75	149	76	401	20	362	54	1059	2	662

Knowledge of Bunk Locations

Table 1 also provides evidence supporting the second hypothesis. The significant differences between open and closed cubicles in the total acquaintance volume are from the average number of bunk locations known (column 3), rather than from acquaintances whose bunk locations are unknown (column 4). The trend is statistically significant and consistent for the 6th and 14th days of training and for massed data, but not for the 11th.

In no case is a significant difference for the number of acquaintances whose bunk locations are unknown associated with barracks type. This finding is consistent with the fact that all other aspects of training were comparable, providing equal opportunity for the development of acquaintances through contacts external to barracks living, such as in classes or the PX.

Interaction

Table 2 gives results for questions concerned with the frequency of interaction. For all comparisons the frequency for within relative to outside

TABLE 3

Frequency of Within and Outside Cubicle "Buddy" Preferences as a Function of Open vs. Closed Cubicle Type Barracks

Day of Training	Open		Closed	
	Within	Outside	Within	Outside
6	89	80	108	47
11	49	81	107	55
14	88	77	91	64

cubicle interaction in response to the questions asked, "spend most of my time with him," and "spend some of my spare time with him," is higher for closed cubicle type barracks. Interaction is significantly more intense (χ^2, $p < .05$) within closed and more distributed throughout the entire barracks in open cubicle type barracks. As would be expected, in closed type cubicles, interaction is more concentrated within the cubicle relative to outside, while in the open cubicle type barracks interaction within the cubicle is less, and that between occupants of different cubicles is significantly greater. These results are consistent with those presented earlier. Taken with them they demonstrate that social life is more restricted to association with others within one's own cubicle under closed cubicle conditions than it is in the open cubicle type of barracks.

"Buddy" Preferences

Table 3 shows the location of "buddy" preferences as a function of cubicle types; whether they were drawn from within the cubicle occupied by the respondent or from other cubicles within the barracks. The trend is the same for all pairs of barracks with the average of within cubicle "buddy" preferences greater for closed than open types. For the 6th and 11th days of training the differences are significant (χ^2, $p < .01$). The trend is in the same direction but not significant for the 14th training day. Living within closed cubicles does not create conditions that permit an occupant to select "buddies" from as wide a range of acquaintances as does living in open cubicle type barracks.

DISCUSSION

Differences in the internal architecture of military barracks have been shown to be related to social relations among occupants. Results from different parts of the study are internally consistent and support the conclusion that closed cubicles significantly increase relationships with others in the same cubicle and reduce them with others located in the same barracks but living in different cubicles.

With comparable physical arrangements for both closed and open cubicle type barracks, identical training and recreational programs, equivalent "free" time periods, and standard regulations regarding within barracks activities (*i.e.*, time of rising, interval between rising and breakfast, etc.) significant differences in the relationships that develop among occupants can be understood in terms of the critical factor varied. Walls around the cubicle in the former but not the latter case function to increase within cubicle interaction and to reduce that between one cubicle and another. The interpretation is that walls, though constituting no legal or geographical boundary limiting interaction, do serve as psychological barriers. Several suggestions are given to explain the effects resulting from the introduction of wall-type barriers.

Different types of social structures develop within cubicles in closed than in open cubicle type barracks. If closed cubicle arrangements increase the cohesiveness of the group, as is indicated by the increased number of in-group "buddy" preferences, then it would be predicted that the penetration of the group by outsiders would be more difficult. Information from interviews with recruits suggest that it is more difficult for an outsider to enter the closed than the open cubicle social system. It can be maintained, for example, that for certain individuals who have a need for group relatedness, closed cubicles create more favorable conditions for the development of high morale. The reason is that a closed cubicle occupant has the opportunity of participating more intensively in a smaller group which develops its own standards and traditions and that possibly has a higher degree of cohesiveness. The increased knowledge of standards and heightened cohesiveness may provide a supporting social framework which increases rather than decreases individual security.

The findings also can be interpreted from the standpoint of their psychodynamic implications. Within one frame of reference it can be maintained that increased interaction among occupants throughout the barracks is undesirable from a morale or mental health point of view. Personal needs of individuals for particular types of relations with others may not be so well satisfied from within the cubicle as would be the case if it were possible to interact more freely throughout the barracks as a whole. Stated differently, the individual who cannot tolerate the more intense interaction in closed cubicle type barracks is placed in conflict by housing-social arrangements. The increased interaction with which he must cope is inconsistent with his usual defensive patterns, with increased likelihood that the conflict will be resolved in a neurotic manner.

Another possible implication is that in closed cubicle type barracks, living arrangements facilitate the selection of friends from the five others assigned to the same cubicle and make more difficult their selection from others

throughout the barracks. None of the five may be as adequate in terms of meeting the needs of an individual for friendship choices as out-of-cubicle barracks occupants might be. Such conditions can have the effect of increasing social isolation with the result that friendship needs may be gratified by regressive symptoms of behavior. Correlated with these considerations is the fact that animosities which arise within the closed cubicle may not be handled so easily as is possible in open cubicle barracks. The reason is that physical proximity creates conditions for further interaction which may increase interpersonal frictions rather than lead to their resolution (1). A closed cubicle member is less able to initiate potentially more satisfactory relations with others outside of his cubicle, due to decreased interaction between cubicles.

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